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NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

**TRAINING IN COMMERCIAL LOGISTICS
PRACTICES TO IMPROVE INVENTORY
MANAGEMENT IN THE NAVY**

by

David J. Randle

December, 1996

Thesis Co-Advisors:

Paul J. Fields
Keebom Kang

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DTIC QUALITY INSPECTED 4

19970502 187

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE December 1996	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE Training in Commercial Logistics Practices to Improve Inventory Management in the Navy		5. FUNDING NUMBERS	
6. AUTHOR(S) Randle, David J.		8. PERFORMING ORGANIZATION REPORT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey CA 93943-5000		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.	
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) The Department of Defense (DoD) has repeatedly been accused of needlessly holding large inventories. In comparison, the commercial sector has drastically cut its inventories over the last twenty years through such practices as Just-In-Time (JIT) and cycle time compression. Some defense analysts have suggested that training in commercial logistics would change the culture of DoD inventory management and promote similar efficiencies. This thesis examines that idea in the context of inventory management of secondary items in the Navy. It describes Navy inventory structure and it examines the causes of excess inventory. It then discusses current training for Navy and DLA item managers and active duty Navy personnel, and how that training is applied at inventory control points and in the fleet. The thesis then looks at commercial practices and the factors necessary for their implementation. It concludes that training in commercial logistics practices would not improve Navy inventory management for several reasons. First, the causes of excess inventory are unrelated to training. Second, the factors necessary to implement commercial logistics practices are not present in the Navy. Finally, training is not a principal agent in cultural change since it is better suited to conforming personnel to an existing culture. The author recommends increased emphasis on Joint Total Asset Visibility as a foundation for improved DoD inventory management.			
14. SUBJECT TERMS Training, Inventory, Commercial Logistics Practices, Just-In-Time, Joint Total Asset Visibility		15. NUMBER OF PAGES 96	
17. SECURITY CLASSIFICATION OF REPORT Unclassified		16. PRICE CODE	
18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18 298-102

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**TRAINING IN COMMERCIAL LOGISTICS PRACTICES TO IMPROVE
INVENTORY MANAGEMENT IN THE NAVY**

David J. Randle
Lieutenant Commander, United States Navy
B.S., United States Naval Academy, 1985

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the


**NAVAL POSTGRADUATE SCHOOL
December 1996**


Author:


David J. Randle

Approved by:


Paul J. Fields, Co-Advisor


Keebom Kang, Co-Advisor


Reuben Harris, Chairman
Department of Systems Management

ABSTRACT

The Department of Defense (DoD) has repeatedly been accused of needlessly holding large inventories. In comparison, the commercial sector has drastically cut its inventories over the last twenty years through such practices as Just-In-Time (JIT) and cycle time compression. Some defense analysts have suggested that training in commercial logistics would change the culture of DoD inventory management and promote similar efficiencies. This thesis examines that idea in the context of inventory management of secondary items in the Navy. It describes Navy inventory structure and it examines the causes of excess inventory. It then discusses current training for Navy and DLA item managers and active duty Navy personnel, and how that training is applied at inventory control points and in the fleet. The thesis then looks at commercial practices and the factors necessary for their implementation. It concludes that training in commercial logistics practices would not improve Navy inventory management for several reasons. First, the causes of excess inventory are unrelated to training. Second, the factors necessary to implement commercial logistics practices are not present in the Navy. Finally, training is not a principal agent in cultural change since it is better suited to conforming personnel to an existing culture. The author recommends increased emphasis on Joint Total Asset Visibility as a foundation for improved DoD inventory management.

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ACKNOWLEDGEMENT

The author wishes to thank Dr. Kang for introducing him to this topic and setting the basic parameters of this research. Thanks to Dr. Fields and Dr. Kang for their foresight, patience, and many long hours that made this thesis possible. Thanks to my colleagues Captain Tom Steiner, USA, and Lieutenant Elysheva Martin, USN, for their cooperative spirit and many constructive ideas. Thanks to my family for their love and support. Most importantly, thanks to God for His grace, mercy, and guidance throughout this project.

B. SCOPE OF THESIS

The thesis' scope is limited to inventory management of secondary items, an inventory category including such things as repair parts, food, clothing, and medical supplies. It does not address end item weapons systems. This thesis focuses on excess inventory, its causes, and possible solutions. It discusses Navy inventory structure, inventory manager incentives, and inhibitors to cultural change in order to provide necessary background information. A full discussion of those topics is beyond the scope of this research.

C. RESEARCH QUESTIONS

This thesis attempts to answer the question "Will training in commercial logistics practices improve inventory management of secondary items in the Navy?" To effectively answer this question, several other questions must also be addressed. First, what are the causes of excess inventory? What training is currently given to inventory managers, and how is it applied? What are commercial logistics practices? What factors are necessary to be able to implement them? Can these practices work in a government setting? After answering these preliminary questions this research tackles the central issue of whether training in commercial logistics practices would benefit Navy inventory management.

D. RESEARCH METHODS

The author obtained the information for this thesis from various sources. Information concerning the causes of excess inventory and inventory manager incentives came from interviews with item managers and their supervisors at Navy and Defense Logistics Agency warehouses and inventory control points. Current Navy inventory structure and supply training information came from unclassified Navy documents.

Information on commercial logistics practices and factors necessary for implementation came from published sources. The author met with the Deputy Chief of Staff (Logistics) (J4) and the Under Secretary of Defense (Corporate Logistics) regarding overall DoD policies. The author also reviewed GAO reports for applicability.

E. ORGANIZATION

There are eight remaining chapters. Chapter II describes current Navy inventory structure and the causes of excess inventory. Chapters III and IV discuss the training currently received by Navy and Defense Logistics Agency inventory managers, and how it is applied at inventory control points. Chapter V looks at several commercial logistics practices that relate to inventory management. Chapter VI discusses the qualitative factors necessary to implement these practices. Chapter VII examines whether these commercial practices could be applied to the Navy, including the impediments to implementation. Chapter VIII ties together the previous chapters and discusses the core issue of the thesis: Could training in commercial logistics practices improve Navy inventory management? Chapter VIII also includes a discussion of what training is and its role in organizational change. Chapter IX contains the conclusions and recommendations of the thesis.

II. NAVY INVENTORY STRUCTURE AND PERFORMANCE

This chapter defines the structure of Navy inventory and discusses the concept of item management, then examines the Navy's performance in inventory management and the causes of excess inventory.

A. NAVY INVENTORY STRUCTURE

Naval inventory is distributed through much the same process as a commercial retailer. In many commercial distribution networks, products from factories are purchased by wholesalers, who sell only to retailers, who sell to consumers. Inventory visibility is lost once the consumer purchases the item, so it is not possible to tell if consumers are hoarding.

1. Item managers

Each item in Department of Defense (DoD) inventory is controlled by an item manager, who is responsible for ensuring that the item is available to military customers. The item manager is responsible for initiating, canceling, and changing procurement actions, tracking stockage levels, and providing customer service. Typically, an item will only have one item manager in DoD. Navy wholesale inventory is under the control of an item manager, who initiates purchases from the factory after a Supply Demand Review determines a purchase is necessary. Unlike the Army, the Navy no longer has a Material Command. Virtually all Navy item managers work at the Naval Inventory Control Point (NAVICP). The Commanding Officer of NAVICP rotates between two locations: Philadelphia, Pa (formerly the Aviation Supply Office), and Mechanicsburg, Pa (formerly the Ship's Part Control Center). The item manager is a civil servant, typically on a GS 5-7-9 track, with possible promotion to GS-11 or 12. It is not uncommon for a Navy item manager to be responsible for 800-1200 items. In general, the more senior item managers manage fewer items which require more extensive forecasting and management, often because of unstable demand histories. (Brennan, Coyle, Panetta, and Pero, 1996)

2. Wholesale Inventory, Retail Inventory, and Ship's Stock

Navy wholesale inventory is stored mainly at Fleet Industrial Supply Centers (FISC). The Navy uses the retail inventory level far less than the other services, since most ships do not carry retail stock. Retail stock consists primarily of consumable items. Navy retail stock is held mainly on tenders (AD/AS) and aircraft carriers (CV/CVN) for sale to other ships, which are analogous to consumers. Once again, inventory visibility is lost once the consumer purchases the item. Purchased inventory is called "ship's stock" and is similar to a consumer holding items in a refrigerator or pantry for short-term future consumption.

3. Repairables and Their Allowances

Repairables are sent to a Shore Intermediate Maintenance Activity (SIMA), shipyard, Naval Aviation Depot, contractor or other service depot for repair. Upon completion of repairs, these items may be sent directly to a customer. If not needed right now, Ready For Issue (RFI) repairables may be held at a FISC until a customer orders them. Ships and stations are required to turn in retrograde carcasses, and ships/stations are not permitted to hold spare repairables beyond their authorized allowance. This allowance is called the Aviation Consolidated Allowance Listing (AVCAL) for ships holding aviation items, the Consolidated Ship's Allowance Listing (COSAL) for ship or submarine parts, and the Shore Consolidated Allowance Listing (SHORCAL) for shore activities holding either. The allowance list is renegotiated prior to each deployment cycle (periodically for SHORCAL) based upon need, changing missions and/or force structure, and changing failure and repair rates. Readiness Based Sparing (RBS) sets the levels of authorized repairables based on readiness impacts, taking into account the local repair capability.

4. Navy Asset Visibility

Navy inventory visibility currently extends from purchase orders outstanding to the retail level. Navy item managers do not have visibility on ship's stock, or on items managed by the Defense Logistics Agency (DLA) or by the other services (Brennan, Coyle, Panetta, and Pero, 1996). Total Asset Visibility is discussed in Chapter V.

5. Determining Agency Cognizance for an Item

Not all items used by the Navy are under the cognizance of Navy item managers. DLA manages most consumables, as well as some repairables and items that have a stable demand history (see table 1, which is based upon DoDINST 4160.26M, 1995, p. 13-1). DLA operates six Inventory Control Points. NAVICP is currently transferring to DLA the responsibility for managing almost all consumable items that are not directly related to a specific weapons program. This transfer should be complete by March 1997. After this date, virtually all items managed by the Navy will be weapons program related.

DLA manages an item unless:
<ol style="list-style-type: none">1) It is a major end item (such as a ship, plane, or tank);2) It is a depot level repairable;3) It is controlled solely by a single agency (service);4) It is non-ordnance nuclear (such as nuclear propulsion);5) The design is unstable or the item is in preproduction testing;6) The item has a special waiver;7) The item has been reclaimed;8) The item is a modification or alteration set or kit; or9) The item is for Foreign Military Sales only.

Table 1. Criteria for DLA to manage an item.

The General Services Administration (GSA) manages many items available to the military as well as other government agencies, primarily office supplies and equipment. Since GSA is not part of DoD, this research does not address it further. The individual services manage the items not under cognizance of DLA or GSA.

6. Demand Forecasting

Demand forecasting is a daunting task, since overall Navy demand for an item is often chaotic, because of the extreme variability of demand from multiple customers with a mixture of demand processes at work. The demand distribution patterns are frequently irregular, and defy mathematical models of forecasted demand (Brennan and Boyarski, 1996, p. 3). One major driver of demand is deployment cycles that are subject to frequent and sudden changes.

7. Supply Demand Review

All Navy-managed items are periodically scrutinized to determine if a supply action is needed, such as new procurement, termination of procurement actions already in process, or recall of items previously disposed and held by Defense Reutilization and Marketing Office (DRMO). This process is called Supply Demand Review (SDR). It is run on a mainframe computer as the Uniform Inventory Control Process (UICP) A/O B10 module. At Mechanicsburg, SDR is done once a month for each item. At Philadelphia, SDR is done as requested by individual Integrated Weapon System Teams (IWST), who schedule it at the most advantageous time from the perspective of their workload. There is a quarterly review of all items that have not been looked at during the previous three months. (Coyle, 1996, p. 2, 17)

8. Demand Forecasting Computer Programs

NAVICP Philadelphia uses a computer model called Statistical Demand Forecasting (SDF) to determine requirements for most non-weapons program consumable items. SDF has been in use for aviation items since 1989. It applies the logic of Statistical Process Control (SPC) to demand forecasting, and is conservative in following trends. It uses exponential double smoothing on five years of monthly data, providing 60 data points. It allows an item manager to set stable forecasts for items in statistical control, and enables the item manager to focus his/her time on items that are out of statistical control. SDF even allows the item manager to track requisitions by command Unit Identification Code (UIC), to see if one command is responsible for an unusual fluctuation in demand. SDF has been a major improvement over the older UICP, greatly reducing procurement cycle churning, and also facilitating long-term contracting. However, SDF can lag behind when a major trend develops. NAVICP is expanding the use of SDF into program items. (Brennan and Boyarski, 1996, p. 9-10)

NAVICP currently uses UICP for most weapons program items. UICP analyzes two years of quarterly data, thus providing only eight data points. It was designed to be responsive to changes in demand. One of its weaknesses is that it often mistakes normal

variation for a trend, frequently creating a churning effect of overordering and then cutting back on procurements. (Brennan and Boyarski, 1996, p. 4-5, 10)

The SDR process will automatically initiate a purchase action on consumable items if the deficit between stocks on hand and stock required is less than \$25,000 at NAVICP Philadelphia or \$1,000 at NAVICP Mechanicsburg. The difference in thresholds is because the aviation items managed by NAVICP Philadelphia tend to be more expensive. SDR will recommend procurement actions subject to item manager review for all repairables and for all consumable items with deficits greater than the above thresholds. (Coyle, 1996, p. 6)

9. Repairables Management

Most Navy repairables are related to a specific weapons program. SDF is not in use yet for most program items, but they are scheduled for the next phase of SDF implementation. Currently, a UICP module called Cyclic Levels and Forecasting (module D01) is used to forecast requirements. In its quarterly run, it computes levels, variances, and means based on forecasts. The B08 module of UICP sets repairables levels. It considers demand, administrative and procurement lead times, repair Turn Around Time (TAT), and the rate and speed of repairable carcass return, and the expected longevity of the repairable. It sets a reorder level based on the procurement lead time plus a safety factor. It also sets an economic retention limit, below which it is not cost-effective to cancel a procurement action. (Brennan and Boyarski, 1996, p. 11-13)

10. Economic Order Quantity, Safety Levels, and Protection Levels

The reorder level is based upon an Economic Order Quantity (EOQ) model. The minimum reorder is for two quarters of demand for aviation items, there is no floor for ship-related items. The maximum amount of a reorder is six quarters of demand. Safety levels account for variability in demand. It is determined by the item's price, past variations in demand, and a consideration of the risk to readiness of a stockout. It also takes into account the complexity and quantity of repairs that the item's history has shown. The safety factor is currently one quarter of demand for aviation repairables, four

quarters for aviation consumables, and 20 quarters for ship and submarine items.

(Brennan and Boyarski, 1996, p. 11-14)

SDR generates a contract termination recommendation when assets on hand are excess to protection levels. Protection levels are established to avoid creating churn in the procurement pipeline because of a slight change in demand during the month or quarter. The protection levels are listed in Table 2.

Type of Document	Protection Level
Contract Already in Place	Reorder Point + Fixed Requirements + (the greater of) EOQ or eight quarters of demand
Purchase Request	Reorder Point + Fixed Requirements + (the greater of) EOQ or two quarters of demand (at Philadelphia), four quarters of demand (at Mechanicsburg)

Table 2. NAVICP Protection Levels

B. NAVY PERFORMANCE IN INVENTORY MANAGEMENT

1. Customary Methods of Evaluation

Navy performance in inventory management is customarily evaluated in terms of its stated goal of supporting the fleet. Numerically, this is expressed in three measures:

1) Supply Material Availability (SMA): the percentage of time a requisition will be filled when it first hits the system, the funded goal is 85%;

2) Number of Backorders (B/O): the total number of line items for which there is no inventory in stock in the system, the goal is to minimize this count; and

3) Average Customer Wait Time (ACWT): the number of days it takes for an average requisition to be filled, the goal is to minimize this number. DLA and the other services commonly refer to this measure as Supply Response Time (SRT).

Navy inventory managers and supply personnel are trained to focus on these criteria, and will use them to express how well they are performing their task. None of these measures are concerned with generation or holding of excess material. In fact, all

three improve when large quantities of material are on hand. (Brennan, Coyle, Panetta, and Pero, 1996)

2. Excess Inventory Defined

Each of the services and DLA define excess inventory differently. The Navy definition is any stock that is above the combination of war reserves, safety level, expected demand during administrative and production lead times, and the EOQ reorder point, plus eight years of demand at current consumption rates. War reserves are not a significant factor in this model, accounting for less than one percent of Navy inventory. (Wambaugh, 1996)

The DLA definition of excess is any stock that is above six years of demand at current consumption rates. The DLA model does not consider war reserves, safety stock, EOQ reorder point, or administrative and production lead times. (Oakley, 1996)

Computing a precise dollar value of Navy excess inventory is beyond the scope of this research. This task is extraordinarily complex because some items are valued at original purchase price, some at current price, and some at scrap value, so a consistent model is not available. Many of these items were purchased years ago or are no longer in production, thus assigning a price to them is largely guesswork. (Brennan, Coyle, Panetta, and Pero) Another factor that makes valuation of excess difficult is that 21% of Navy weapons systems are used by other services. Consequently, stocks for these items that would be excess to the Navy could be needed by the other services that use them. (Department of Defense Joint Staff, 1996, p. 5)

3. Causes of Excess Inventory

This research has uncovered a multitude of causes for excess inventory. This section gives a short discussion of each and clarifies each cause with some examples. Many of the examples come from other services, either because there is not a suitable Navy example or because the other service example is clearer. Nonetheless, the potential for generation of excess material in the Navy exists from each of these causes, regardless of which service provided the example.

a. *Decrease in Requirements*

If requirements for an item decrease and there is enough material on hand to support the older, higher requirements, it will be labeled as excess. A decrease in requirements can result from the weapons system being phased out, reliability improvements, a change in operational use, reduction in repair cycle time, reduction in administrative or production lead time, or a reduction in war reserve requirements.

Examples include:

1) As Oliver Hazard Perry (FFG-7) class frigates were sold or transferred to the USNR, demand for ship-specific items decreased.

2) Strengthening the corners of ALE-39 Chaff/IR buckets increased their Mean Time Between Maintenance (MTBM), and reduced requirements.

3) As some EA-6B aircraft transition from carrier-based to land-based USAF support, demand for some items should decrease, because the planes will experience less corrosion when they are removed from a salt-water environment, and aircraft components will experience fewer failures since they will not undergo the shock of catapult launches or arrested landings.

4) Shortened repair cycles require fewer repairable items in the pipeline that supports operating forces.

5) The Navy and DLA have succeeded in reducing administrative (contracting) lead time. Paperless Ordering Procedures (POP) have played a large role. This reduction in lead time means that less inventory is required, because the item can be procured more quickly. If large stocks are on hand, more will now be excess. (Nixon and Wolfe, 1996)

6) Requisitions might be placed for anticipated operations that do not materialize, such as some contingency operations. This could potentially generate excess material.

b. *Receiving the Wrong Consumable Part*

A unit may order the wrong part because of a keypunch error, or poor manuals or technical assistance. Also, a supply activity may have inaccurate stock location files, which would result in the wrong part being sent to the unit. If the item was ordered correctly, the ordering activity can submit a Report Of Discrepancy (ROD) and

receive the correct item at no additional charge. If the item was ordered incorrectly, there is currently no practical mechanism for an operational unit to recoup money it has spent on this part.

c. Lack of Asset Visibility

An inability of the Navy, DLA, and the other services to see each other's inventories can result in redundancy. 21 percent of the Navy's weapons system support items are multiple use; the corresponding figures are 43 percent for the Army, 34 percent for the Air Force, and 73 percent for the Marine Corps. It is quite conceivable that a service may buy an item which another service is holding in a warehouse unused (Department of Defense Joint Staff, 1996, p. 5).

For example, the Government Accounting Office (GAO) found 69 modular radio transmitters owned by the Army and classified as excess stored at Warner Robbins AFB. These are dual use USA/USAF radio components, valued at approximately \$16,000. The Army had not made these items available, and the USAF had not attempted to obtain disposition authority. (GAO/NSIAD-95-64, 1995, p. 9)

d. Lack of Customer Confidence

Operating forces may not have confidence in the ability of the supply system to support them, so they may hoard items, and deliberately order more than they need. This stems from a philosophy of "Readiness at Any Cost." During Desert Shield, when the Army's 24th Infantry Division deployed to Saudi Arabia on three weeks notice. The 24th ordered items two and three times for each requirement, because they did not have confidence in the system. Since the 24th was in a combat zone and had top priority on requisitions, this double and triple-ordering not only created excess material in the 24th, it hampered the readiness of subsequently deployed units by taking needed items out of the supply system. Units deploying after the 24th followed suit in multiple ordering. As a result, approximately 40,000 Sealand containers were sent to the Arabian Gulf during Desert Shield/ Storm. About 22,000 of these were never opened. The Joint Staff now sometimes refers to Desert Shield/Storm as "Desert Surplus." (Blickley, McKee, Randles, Veilleux, 1996) In contrast, the Navy fortunately has less possibility of

multiple ordering of the same requirement because of powerful Supply Departments coupled with improved logistics information.

e. Base Realignment And Closure (BRAC)

As force structures contract and bases are closed or realigned under BRAC, demand will decline and cause excess inventory. In addition, closing a base almost always results in identifying inventory that is not on the accountability records. This happened when DLA closed its Memphis, Ogden, and Columbus depots. Personnel at Defense Depot Letterkenny Pennsylvania, slated for closing in 1998, stated "We'll find a lot of inventory we didn't know we had when we close down." (Estes, Miller, Rosenberry, and Snyder, 1996)

Items from activities that were closed or realigned under BRAC do not stratify into excess for two years. This allows some of these stocks to be consumed, and provides continuity in the excess management process. Absence of this provision would cause most stocks from BRACced activities to immediately go excess, since closing a base increases the supply of material while decreasing the customer base. (Oakley, 1996)

f. Support of Allies

Support of our allies may force United States forces to hold items that appear to be excess. These may be from Foreign Military Sales (FMS) contracts or from regional agreements. A Navy FMS example is two \$45,350 electric pumps held at FISC Norfolk. These pumps are for destroyers that are no longer in United States service, but are still in foreign service. The United States holds the inventory because the nation that purchased the destroyers does not wish to buy these pumps until it needs them, and it is not economical for the United States to dispose of them. (GAO/NSIAD, p. 10-11) Another Navy FMS example is the A-4 aircraft that has been sold to many nations. The United States must retain spare parts to meet demand from these aircraft, even though it is no longer in United States use. (Waite, 1996)

A good example of a regional agreement forcing the United States to hold excess is 155mm Howitzer ammunition in the Republic of Korea (RoK, commonly called South Korea). Although the RoK manufactures this ammunition, they do not store it. If

North Korea were to suddenly attack, the United States Army would have to give some of its stockpile to the RoK Army, since RoK forces hold 3/4 of the front line. (Waite, 1996)

g. Poor Estimates of Support Required for Initial Procurement

When a new weapons system is fielded, the initial estimates of which components will break and how often come from the contractor in an Interim Support List (ISL). There is currently no incentive for the contractor to limit the size of the ISL, since they profit from each additional item they can include on it. A good example comes from the Air Force. The B-2 bomber ISL contained 6,000 line items. After two years of operational use, only 400 of the 6,000 had been used at all. (Waite, 1996)

h. Demilitarization

Old military equipment must be demilitarized before it can be either sold or disposed. The funding comes out of Operations and Maintenance (O & M) dollars, the same dollars the services use to pay for current operations. In this time of tight funding, there is simply not enough priority to pay for demilitarization of old equipment when the services need the money for today's operations.

An example would be old radar components the author observed being destroyed at Defense Depot Letterkenny Pennsylvania. The exact frequencies these radars generate are classified, so the item must be carefully dismantled in such a way that it cannot be reconstructed. (Estes, Miller, Rosenberry, and Snyder, 1996)

Another example at Letterkenny is 3,032 backpack-style riot control dispensers. This model is no longer in use, but it cannot be simply thrown away because of the potential for terrorist action. This model can be converted to a garden sprayer and then sold on the open market, however, the O & M dollars needed to do that are not available. (Estes, Miller, Rosenberry, and Snyder, 1996)

I. Item Manager Incentives

As mentioned earlier in this chapter, the primary measures of effectiveness of an item manager all promote readiness and do not address creation or retention of excess material. Both in the Navy and DLA, item managers perceive that the worst thing

they can do short of breaking the law is to run out of stock on an item. (Brennan, Coyle, Panetta, and Pero, 1996, and Nixon and Wolfe, 1996)

The author observed an item manager “doctoring” demand data to increase the computer-generated purchase quantity from one to 40. This happened after the item manager had spoken with the PM about next quarter’s Planned Program Requirements (PPR) for a newly fielded system. This particular instance is not necessarily bad, in fact this is precisely the kind of liaison between item manager and PM the author would like to see. However, if used incorrectly, this practice has the potential to create excess.

j. Economic Considerations

Warehouses that hold part of the National Stockpile cannot sell or dispose of these items by law. In addition, selling some of these items has the potential to devastate markets that would be flooded by the abundant supply. Consequently, the military simply maintains its stocks of these commodities. For example, Defense Depot Letterkenny Pennsylvania holds the following items in storage as part of the National Stockpile.

Commodity	Tons in Storage	Square Footage Occupied
Asbestos	549.9	42,966
Chromite Refractory Ore	30,563.8	158,000
Lead	662.5	213,000
Manganese Ore	72,359.7	316,000
Nickel	5,946.5	71,000
Talc	466.9	7,161
Tannin	13,301.1	296,060
Zinc	8,517.5	71,000

Table 3. Items in National Stockpile Storage at Defense Depot Letterkenny Pennsylvania

k. Contracting Regulations

Unlike the private sector, the government must comply with the provisions of the Competition In Contracting Act (CICA) and other regulations designed to promote equity and social goals in government contracting. These requirements add months to the contracting process, thus increasing the reorder point since more stock is needed to cover demand during the replenishment period.

C. SUMMARY

This chapter has discussed the Navy system of inventory management for secondary items, and examined some of the causes of excess inventory. The next chapter examines training received by inventory managers, both civilian and military.

III. NAVY AND DLA TRAINING OF INVENTORY MANAGERS

This chapter discusses training of inventory managers in the Navy and DLA, with particular emphasis placed upon training in commercial logistics practices.

A. TRAINING OF NAVY INVENTORY MANAGERS

1. Civilian Item Managers

There is no formal training required to become an item manager, however, Navy item managers must have a college degree (preferably in a business major) with a 3.5 GPA. In addition, NAVICP has an optional training program called ICP Academy. Three times per year, ICP Academy holds two weeks of classroom training in different areas of supply expertise. This is combined with a follow-on formal mentoring program.

In addition to ICP Academy, NAVICP offers half-day training courses in specific skill areas. Some item managers perceive that the half-day courses are preferable, because these courses allow them to keep up with their daily workload while learning new skills. They feel that their daily routine is simply too hectic to allow them to take two full weeks off for training. (Brennan, Coyle, Panetta, and Pero, 1996)

The two item managers interviewed in this research did not receive any formal training prior to assuming their positions. One had been working as an item manager for nine years, the other for 17 years. Neither had graduated from college; one had previously been a GS-5 Supply Clerk. They learned how to be item managers through on-the-job training and an informal network of mentors. In addition, they had taken advantage of NAVICP half-day training courses. Each entered the position on a GS 5-7-9 track at a time when item manager and File Maintenance (referring to weapons system item files) had separate Position Descriptions. NAVICP now blends these two areas together, with the trainee on a GS 7-9 track. (Brennan, Coyle, Panetta, and Pero, 1996)

2. Active Duty Officers

All Navy Supply Corps Officers attend a six-month Officer Basic Qualification Course in Athens, Georgia, prior to their first assignment in the fleet. The course is designed to teach newly commissioned ensigns basic technical instruction in Navy supply procedures. The course is an in-depth study of the supply system covering topics such as supply manuals, personnel administration, procurement, accounting, management of repair parts, subsistence management, retail operations such as ship's stores and services, disbursing, logistics, Automated Data Processing (ADP), and supply quality assurance. The course is procedural in nature rather than conceptual. Students are required to demonstrate practical knowledge, including the ability to post all forms and files in each functional area. There is no specific training in commercial logistics practices such as Just-In-Time (JIT) inventory, Material Requirements Planning (MRP), or EOQ models. These practices are discussed further in Chapter V. (Chief of Naval Education and Training, 1995)

Lieutenants and junior Lieutenant Commanders who are en route to a billet as the Supply Department Head on a ship or submarine equipped with the SNAP II/III computer system attend the Supply Officer Department Head Course, also in Athens, Georgia. Students receive a six week overview of technical functional areas such as supply and financial management, the Planned Maintenance System (PMS), food service, disbursing, retail operations, postal operations, hazardous materials management, and personnel management. Training in commercial logistics practices is not addressed. (Chief of Naval Education and Training, 1995)

3. Active Duty Enlisted

Navy enlisted supply personnel are composed primarily of Storekeepers (SK) and Aviation Storekeepers (AK). The SK and AK class "A" schools are taught to selected junior enlisted personnel following completion of recruit training. Successful completion of this "A" school is not mandatory to be a designated SK or AK. However, without "A" school a Sailor has additional requirements to advance in rank and must acquire the foundation of technical knowledge required of a fleet SK or AK on his or her own.

The SK course is 57 days long, the AK course is a day longer. They are both taught at Naval Technical Training Center, Meridian, Mississippi. Each of these courses is procedural in nature, covering topics similar to the Officer Basic Course, but at a level appropriate to junior enlisted personnel. Hands-on training and practical performance are emphasized. Topics covered in the SK course include identification of the components and functions of the Navy supply system, performance of supply-related administrative functions, technical research, establishment and maintenance of stock records and related files, issuance of material, procedures for material receipt and distribution, inventory of stock, preparation of material for transfer or shipment (with emphasis on documentation, preservation, and packaging), preparation of requisitions, and performance of OPERating TARget (OPTAR) financial accounting. The AK course is similar, and adds topics in Military Standard Requisition and Issue Procedures (MILSTRIP), squadron and Aircraft Intermediate Maintenance Department (AIMD) material control functions, and Supply Support Center (SSC) operating procedures. Training in commercial logistics practices is not addressed. (Chief of Naval Education and Training, 1995)

B. TRAINING OF DLA INVENTORY MANAGERS

In comparison with the Navy, DLA has a far longer and more standardized training program for its item managers. Most new hires enter under the Outstanding Scholar Program. They must have a college degree in business with at least a 3.5 GPA. There are seven months of formal classroom training, followed by a mandatory mentoring period of three years. The classroom training is a core curriculum similar to that received by active duty Navy personnel. It is procedural in nature, but does not cover the commercial logistics practices discussed in Chapter V. DLA training was previously conducted in Columbus, Ohio, but is now available in several DLA locations. DLA Mobile Training Teams (MTT) teach refresher courses at DLA sites throughout the nation, the longest of which is three weeks. In addition, remedial or refresher training is available via Computer Based Training (CBT) at DLA ICPs. However, the training

courses for the DLA Supply Asset Material Management System (SAMMS) computer system are not comprehensive. Each course covers a specific skill area, and does not necessarily relate to the other courses. Item managers must learn to use most of SAMMS through on-the-job training or on their own. (Smith, 1996)

A majority of the item managers at DSC Richmond had previous Civil Service supply experience and a college degree. The two item managers interviewed during this research with at DSC Richmond each had over 17 years experience. One had previously been a Supply Clerk. They are on a GS 5-7-9 track similar to NAVICP. One had been to four follow-on training courses taught at DSC Richmond in the previous two years, the other item manager had not been to any. Just as at NAVICP, item managers perceive that their daily schedule is too hectic to allow much time for training. Because of the defense drawdown, DSC Richmond had not had any new hires (except in Quality Assurance) in over five years. Over two thirds of DSC Richmond's work force is within ten years of retirement. (Nixon and Wolfe, 1996)

Defense Supply Center (DSC) Richmond has adopted a Personnel Qualifications Standards (PQS) system based upon the PQS used in the Navy. This PQS covers all of the major areas with which an item manager should be familiar, and typically takes over a year to complete. PQS certification is not intended to be a substitute for training. PQS is not mandatory, but it does count for promotion points. (Smith, 1996)

C. SUMMARY

This chapter has listed the inventory training received by Navy and DLA personnel. All of the training discussed was procedural in nature, and did not include commercial logistics practices. The next chapter discusses how this training is applied to inventory management, both at NAVICP and in the fleet.

IV. APPLICATION OF INVENTORY TRAINING IN THE NAVY AND DLA

This chapter discusses how inventory training is applied at NAVICP, DLA ICPs, and in the fleet. It covers the responsibility, authority, and incentives for NAVICP and DLA item managers, DLA senior inventory personnel, and Navy active duty supply personnel.

A. NAVICP ITEM MANAGERS

1. Responsibility

The item manager is responsible for ensuring that sufficient quantities of each item stocked is available to the fleet. The typical item manager at NAVICP Philadelphia is responsible for managing 800-1200 items. In general, the more senior item managers manage fewer items which require more extensive forecasting and management, often because of unstable demand histories. (Brennan, Coyle, Panetta, and Pero, 1996)

2. Authority

Item managers work as part of an Integrated Weapons System Team (IWST) that includes equipment technical experts, contracting specialists, and logisticians. The logistics function was previously performed by AIR-412 at Naval Air Systems Command. Together, this team makes decisions about the items they manage. The intent of IWST is to avoid making decisions in a vacuum, such as engineers proposing changes that cannot be supported logistically, or contracting specialists procuring items that will soon be obsolete. (Wambaugh, 1996)

Item managers have considerable latitude to take the supply actions necessary to satisfy fleet requirements. They can initiate purchase requests, request termination or cutback of purchase requests, retain items in Navy warehouses to stop them from being excessed, and can contact DRMO to recall items already excessed for disposal/reutilization. IWST members frequently contact a weapons PM concerning items they manage, asking about program changes, item modifications, and Planned Program

Requirements (PPR) for new weapons systems. PPR can dictate placing a purchase order when demand data is insufficient.

For small dollar value purchase orders (consumables with a total cost less than \$25,000 at Philadelphia and \$1,000 at Mechanicsburg), UICP and SDF computer programs initiate purchase orders during SDR. For larger dollar values, the computer only recommends supply actions; the item manager can modify or override these recommendations based upon personal judgement. Item managers must be cognizant about whether an item belongs to a program which is "ascending" (a new program with increasing demand), stable, or "declining" (being phased out). (Brennan, Coyle, Panetta, and Pero, 1996)

Item managers utilize an electronic bulletin board called "IMNotes" to post special information about the items they manage. This information often relates to contract status or availability projections. Major Navy installations have access to the NAVICP database, so Supply officers can access this information electronically. This enables item managers to spend their time managing items, rather than on the phone repeating the same information to dozens of commands. (Brennan, Coyle, Panetta, and Pero, 1996)

Table 4 (taken from Coyle, 1996, p. 21) lists the approval levels for NAVICP procurement for each level of inventory control personnel. Note that this amount is for each separate procurement action. There is no limit on the total amount of money an item manager can obligate. NAVICP has recently consolidated the Philadelphia and Mechanicsburg approval levels to make them consistent.

3. Incentives

Navy item managers are motivated to support the fleet. Their effectiveness is frequently evaluated by SMA, the number of back orders, and ACWT for the items they manage. When asked "What do you do to get promotions and raises around here?" they responded as follows:

- 1) Keep SMA high;
- 2) Keep back orders and ACWT low;

Philadelphia		Mechanicsburg	
Position	\$ value	Position	\$ value
GS-9 Item Manager	up to \$99,999	GS-9 Item Manager	up to \$99,999
GS-11 Item Manager	\$100,000- \$299,999	GS-11 Item Manager	\$100,000- \$299,999
GS-12 Section Head	\$300,000- \$499,999	GS-12 Branch Head	\$300,000- \$499,999
Branch Head/ Deputy	\$500,000- \$999,999	Division Director/ Deputy	\$500,000- \$999,999
GM-15 Director/ Deputy	\$1,000,000- \$4,999,999	Department Director/ Deputy	\$1,000,000- \$1,999,999
		Group Head/ Deputy	\$2,000,000- \$4,999,999
Commanding Officer	\$5,000,000 and above	Commanding Officer	\$5,000,000 and above

Table 4. Approval Levels for NAVICP Procurement

- 3) Terminate or cut back unnecessary procurements before they take effect;
- 4) Continue education by taking courses after hours; and
- 5) Take Navy training courses.

The Navy's BOSS III Program provides personal awards for personnel who report overpriced items, save procurement dollars, or dispose of unneeded material. In practice, BOSS III awards are infrequent, so this program has not had a significant impact on item manager behavior. They perceive that the worst thing they can do short of breaking the law is to run out of stock on an item. (Brennan, Coyle, Panetta, and Pero, 1996)

When an item is excess, Navy item managers often hold it on site until DRMO identifies a buyer, since item managers are assessed a transaction charge for shipping excess material to DRMO (a DLA activity) of roughly \$33 per line item, regardless of

quantity. They are assessed the same transaction cost again when DRMO moves the item out of its warehouse. By holding the item on site, they are only charged once (Brennan, Coyle, Panetta, and Pero, 1996).

B. DLA ITEM MANAGERS

1. Responsibility

The DLA concept of item management is quite similar to the Navy's concept. The mission of DLA item managers is to support readiness throughout the services. The typical item manager at DSC Richmond manages 1100-1800 items. This is higher than the typical item count for a Navy item manager, in large part because the services have cognizance over weapons program related repairables and consumables, which are more difficult to manage than the common consumables controlled by DLA (Waite, 1996). Just as in the Navy, the more senior item managers handle fewer items which require more extensive forecasting. The GS-11 item managers at DSC Richmond typically manage 300-500 items. (Nixon and Wolfe, 1996)

2. Authority

As in the Navy, DLA item managers have considerable latitude to take the supply actions necessary to satisfy service requirements. They can initiate purchase requests, request termination or cutback of purchase requests, retain items to stop them from being excessed, and can contact DRMO to recall items already excessed for disposal/reutilization. Managers often act upon recommendations generated by the DLA SAMMS computer systems; SAMMS checks twice per week to see which items have breached their ROP. Once again, the item manager can modify or override these recommendations based upon personal judgement (Nixon and Wolfe, 1996). Since DLA does not manage weapons-program related items, they do not concern themselves with ascending or descending programs. The vast majority of items they manage have relatively stable demand. (Waite, 1996)

DLA item managers have less dollar authority than do Navy managers. This is related to the types of items each agency manages. The weapons systems controlled by the services have a higher dollar value than the common consumables managed by DLA. Table 5 lists DLA Approval Levels for Repair, Excess, Procurement, and Cutback. (Nixon and Wolfe, 1996)

Review Levels for Supply Actions		
	Repair and Excess	Procurement and Cutback
GS-9 through GS-11	up to \$75,000	up to \$25,000
GS-12	\$75,000 - \$149,999	up to \$25,000
GM-13	\$150,000 - \$399,999	up to \$25,000
GM-14/15	\$400,000 - \$749,999	\$25,000 - \$749,999
Director/ Deputy for Material Management	\$750,000 and above	\$750,000 and above

Table 5. DLA Approval Levels for Repair, Excess, Procurement, and Cutback.

3. Incentives

There is strong consistency between the Navy and DLA in the motivation and incentives of item managers. DLA item managers are motivated to support readiness, and are evaluated by SMA, number of back orders, and SRT. When asked "What do you do to get promotions and raises around here?" they responded:

- 1) Keep SMA high;
- 2) Keep back orders low;
- 3) Complete PQS, since it counts for promotion points; and
- 4) Continue education by taking courses after hours.

Since 1993, the number of inventory personnel employed at DSC Richmond has increased from 1,800 to 2,000, while the item count has more than doubled. This has significantly increased the workload per person. Item managers perceive that excess inventory is bad since it takes time to manage but does not contribute to their performance

measures. Their perception is that getting rid of excess leaves them fewer items to manage, helping to reduce their workload.

In contrast to the Navy, DLA item managers do ship excess material to DRMO. The DLA item managers interviewed in this research were aware of both the transaction cost and the storage cost imposed by DLA. Since the holding cost applies whether the item stays in a DLA warehouse or goes to DRMO, item managers were indifferent to it. Their reason for shipping excess material to DRMO is to respond to the concerns of senior inventory personnel. Senior personnel have performance measures that reward getting rid of excess inventory, as delineated in the next section.

C. DLA SENIOR INVENTORY PERSONNEL

1. Responsibility

In this research, DLA senior inventory personnel are defined as military O-5 and above, and GM-13 and above, who are directly concerned with inventory management functions. These personnel are responsible for the overall leadership and proficiency of the DLA supply network.

2. Authority

DLA senior inventory personnel typically hold authority over several dozen item managers. They review and approve procurement requests commensurate with the dollar limitations listed in Table 5. Because of the large dollar values involved in each purchase request, DLA uses these senior personnel to ensure fiscal responsibility for public funds.

3. Incentives

The incentives for DLA senior personnel are different than those of their item managers. In addition to SMA, SRT and number of back orders, their measures of effectiveness (used to evaluate them for promotions and raises) are:

- 1) Sales to Inventory Ratio; and
- 2) Percentage of Material Considered Excess.

DLA's goal is to maximize the sales to inventory ratio, defined as the total dollar sales from a DLA facility divided by its average inventory. This ratio is maximized by holding a small inventory of high demand items. Excess inventory reduces this ratio by increasing inventory without increasing sales (Waite, 1996). DLA tries to minimize the percentage of excess material held. As of July 1996, \$427 million of DSC Richmond's \$2.78 billion inventory (19.1 percent) was considered excess. This was above the goal of 17.5 percent given them by DLA headquarters. (Oakley, 1996)

D. ACTIVE DUTY PERSONNEL IN THE FLEET

1. Responsibility

The responsibility of active duty supply personnel is to maximize readiness by ensuring the ship can perform its mission. The chain of command for supply personnel leads to a "warfighter," whether in the surface, submarine, or aviation communities.

2. Authority

The authority of active duty personnel at the unit level is limited. They cannot keep spare repairables above their authorized AVCAL/COSAL/SHORCAL. These allowances are negotiated at NAVICP roughly 15 months prior to a major deployment. Readiness Based Sparing (RBS) has generally reduced the number of spares carried onboard, while increasing the number of bit-and-piece consumable items needed to repair them. RBS has almost eliminated "insurance items" (those with a low probability of failure but dramatic consequences if they do fail). Since the number of spares directly affects readiness, supply officers try to work around the constraints of RBS to maximize their onboard allowances. Tight funding and limited secure storage space onboard forces active duty personnel to ensure that the consumable items they purchase have rapid inventory turnover.

3. Incentives

The incentives for active duty supply personnel are virtually identical to those of Navy item managers. In keeping with the goal of maximizing readiness, fleet personnel

receive better performance evaluations if they:

- 1) Keep SMA high;
- 2) Keep back orders and ACWT low;
- 3) Terminate or cut back unnecessary purchases before they take effect;
- 4) Continue education by taking courses through Navy Campus (on shore) or the Program for Afloat College Education (PACE) on deployment; and
- 5) Complete Navy training and correspondence courses.

E. SUMMARY

This chapter has examined how the training discussed in Chapter III is applied at NAVICP, DLA, and the fleet. The next chapter covers some of the logistics practices currently used in the commercial sector to improve inventory. The next several chapters explore whether training in these practices might improve Navy inventory management.

V. COMMERCIAL LOGISTICS PRACTICES

This chapter discusses some of the logistics practices currently used in the commercial sector. In this research, commercial logistics practices are defined as those techniques, methods, customs, processes, rules, guides, and standards normally used by business, but either applied differently or not used by the federal government (Defense Systems Management College, p. ES-1). This chapter covers the origin of these practices and lists those practices most applicable to inventory management.

A. ORIGIN OF COMMERCIAL LOGISTICS PRACTICES

Business competition is now more intense than ever. Rising costs, the frantic pace of business and the advent of truly global competition have forced companies to redouble their efforts to satisfy customers while cutting costs. Improved logistics offers a way for firms to differentiate themselves from their competition while reducing costs and adding value to their products. Andersen Consulting (Capacino, 1990, p. 2) found three primary factors that motivated firms to take a new look at logistics:

The first factor is the increased importance of logistics as a part of the overall marketing mix. Customer service, and specifically delivery service, has increased in importance. Leading companies are making quality, and particularly quality customer service, a cornerstone of their business. Many companies have learned that their customers will not tolerate poor customer service, and that their customers will often pay a premium for superior customer service....In studies across a number of industries, we have documented that customer service performance correlates closely with market share....

Secondly, logistics is becoming an increasingly important cost element. With manufacturing costs declining, logistics costs become more visible and more important. The full channel costs can account for 25% to 30% of the cost of goods sold....

The third factor driving increased attention to the integrated logistics management concept is the evolution of information technology.

Advanced information systems make integration of the logistics functions possible.

For many firms, logistics is the last area to come under scrutiny for process improvement and cost reduction. Purchasing, marketing, production, and finance have each gone through periods of intense focus as companies have sought to cut costs without cutting value. Now the same is happening to logistics.

The vast increase in computing power in recent decades is particularly striking. The rise of facsimile transmissions, networked information systems, EDI, and e-mail have completely transformed the business landscape. No longer are large warehouses, long lead times, and a rigid pyramidal structure needed to operate a firm. An example of a modern company that has taken advantage of computers and rapid information flow is the Frito-Lay Corporation. Every Frito-Lay salesperson has a hand held computer that records each transaction made as the salesperson delivers stock to a supermarket and removes damaged or stale products. At the end of the day, the salesperson transmits this information to headquarters, providing information on sales, returns, damages, and inventory. While the salesperson sleeps, Frito-Lay stockage personnel refill the salesperson's truck, since they know exactly what to bring to the salesperson's house. Frito-Lay top management is able to track sales of each of its 10,000 member sales force on a daily basis, thanks to the power of information technology, and the salesperson no longer needs to reconcile a route sales book. This kind of computing power and rapid communication could only be dreamed about as little as twenty years ago. (Applegate, McFarlan, and McKenney, 1996, pp. 292-349).

B. COMMERCIAL LOGISTICS PRACTICES APPLICABLE TO INVENTORY MANAGEMENT

There are a number of concepts that together make up commercial logistics practices. The following apply directly to inventory management.

1. Just-In-Time

In traditional inventory management theory, inventory is "pushed" to stores based on what the manufacturer expects the customer to order. More modern systems rapidly "pull" inventory in response to customer demand. This requires suppliers to consistently meet short lead times and high fill rates without back orders.

Under the Just-In-Time (JIT) philosophy, inventory is not stockpiled at the factory. Instead, close relations with suppliers ensure that raw materials and input parts arrive "just in time" for production workers to use them. Inventory is frequently measured in hours rather than days.

For example, Audio manufacturer Bose Corp. has used JIT to reduce its inventory. Its suppliers are physically located in the Bose purchasing office, replacing the material planner, the buyer, and the salesperson. This system works for transportation as well. Lance Dixon, Bose director of purchasing and logistics explains (Andel, 1994, pp. 95-102):

We're now able to use the material in transit that's flowing from around the world into our plants as a routine inventory location. Most inventory sits on the shelf and you have money tied up in it. We brought our transportation suppliers on site - the manager from Roadway for trucking and the manager from Proctor for import/export activity - in one room under my transportation manager. This gives us a command center for every mode of transportation, inbound and outbound. Under JIT II, when the panicky buyer calls his brother in transportation, this elaborate computerization and control network allows them to find all locations where part number 123 exists. One may be on the dock in Taiwan, one may be halfway across the ocean, one may be coming into Seattle, one on a railcar, and one unloading in Boston. Everything happens on my floor space, and these companies sitting in this room can work together in crisis situations.

The advantages of JIT are that it virtually eliminates standing inventory and its associated costs. The disadvantage is that a late delivery or poor quality on one component can stop an entire production line.

2. Outsourcing

Outsourcing is the practice of contracting out non-strategic functions. This allows a company to concentrate on its core competencies and let other firms handle ancillary functions. Outsourcing often enables a company to maximize its return on investment by better serving its customers, and can serve as a barrier to entry for potential competitors. In the past, accounting, payroll, and temporary office help were often outsourced. Now logistics is increasingly treated the same way, as companies realize that their expertise lies elsewhere. Menlo Logistics is a corporation that coordinates logistics for many of America's largest companies. They told the following story about one of their clients (1993, pp. 2-3):

The company had started in the 1980s as a small chain with a dozen outlets in several states. By 1993, it had grown to several hundred outlets nationwide. Previously, the customer allowed its suppliers to control transportation, sending goods as prepaid freight orders to each individual store. The company had no in-house traffic managers or analysts to track the flow of freight- which wasn't a problem with only a dozen stores. But the company was due for a change. Menlo's number crunchers, using sophisticated software models to analyze freight flow, order scheduling and equipment needs, came up with a plan that shifted control for transportation decisions from the supplier to the customer, and in the process, slashed transportation costs substantially....The plan took the same amount of freight moving as 60,000 smaller, high-cost shipments a week and consolidated them to 2,500 larger moves per week, with better control, time-definite delivery, and inventory management than before. And at dramatically lower costs.

The practice of outsourcing may go so far as to create a "virtual company", where even the employees are temporary hires. Virtual companies have fluid, moving organizational boundaries, and rely on a variety of supplier relationships to provide services on demand (Heizer and Render, 1996, p. 534). Mintzberg and Quinn provide an example of a company that out sources all of its production (1996, p. 64):

Nike Inc., is the largest supplier of athletic shoes in the world. Yet it out sources 100% of its shoe production and manufactures only key technical components of its 'Nike Air System.' Nike creates maximum value by

concentrating on preproduction (research and development) and postproduction activities (marketing, distribution, and sales).

3. Direct Delivery

Direct delivery is another form of a “pull” inventory system. A manufacturer ships products directly to a retailer’s store, instead of to the retailer’s warehouse. The advantage is that the retailer has eliminated inventory holding costs on that item, and only calls for the item to be delivered to the store when needed. A disadvantage is that shipping costs will probably increase, since there will usually be more Less Than Truckload (LTL) shipments.

While this arrangement can be great for the retailer, it can cause problems for manufacturers. An example of how this can impact suppliers was cited in the Wall Street Journal of October 27, 1995. Christina Duff reported that “Department stores are increasingly placing onerous logistical demands on apparel suppliers. She went on to say:

Department stores have started to increase their emphasis on logistics. Take the rules about shipping. Packing labels may be required to include, say, eight specific bits of information. Often the label has to be affixed to a specific place on a particular kind of shipping box. Then the clothes have to be prepriced and hung, facing a certain way, on special hangars. And stores will accept the goods only on certain days.

4. Electronic Data Interchange and Total Asset Visibility

EDI is a standardized data transmittal format that enables firms to track inventory worldwide, providing Total Asset Visibility (TAV). Items are tracked electronically, typically by a scanner that scans a barcode containing the item’s complete description and destination. EDI enables inventory managers to know the location of all company inventory, and breaks down the old barriers of inventory “pigeonholed” in warehouses. Before EDI, one company warehouse could be holding stock needed by another branch of the company, but the second branch would have no way of knowing inventory was available, so they would order more of the same part.

An example of a company using EDI is Sears Logistics Services. Menlo Logistics (1993, p. 4) reported that:

Vendors send an advance shipment notification to Sears by EDI. Sears' computer then determines if the shipment is truckload or LTL. LTL shipment information then is transmitted electronically to the Menlo computer, which responds with the optimum carrier and routing, relaying that information via EDI Sears determines the rate and pays Menlo through EDI. The result is a smooth-running process with minimal paperwork and easy communication between shipper and service provider.

While EDI can be a tremendous asset, one concern is that it is only as good as the input data.

5. Cycle Time Compression

Cycle time compression is a reduction in the time between when the customer places an order and when the customer receives the order. There are several transactions in this process, including order placement and transmittal, order processing, payment, picking the item in the warehouse, packing it for shipping, transporting it to its destination, and tracking its status. Automating, consolidating, or running these elements in parallel can dramatically reduce overall cycle time. Johnson & Johnson (J & J) greatly improved its cycle time as follows (Andel, 1994, pp. 95-102):

J & J uses Manugistics, an integrated set of supply chain management applications, to help it meet the replenishment demands of all its customers. Using information from EDI transmissions, this software links the Support Center with J & J's customers and distribution centers. The system is tied directly to the company's order management system -- which includes order processing, transportation load building, and sales reporting systems. Information from these systems is fed downstream to each of the separate operating units to provide decision support throughout the organization.

By linking all of these functions electronically, J & J has slashed its cycle time, while at the same time improving accuracy.

C. SUMMARY

This chapter described some of the most commonly used commercial logistics practices that apply directly to inventory management. The next chapter discusses the key factors necessary to implement these practices.

VI. FACTORS REQUIRED FOR IMPLEMENTATION OF COMMERCIAL LOGISTICS PRACTICES

Improving corporate logistics by using modern commercial logistics practices is not just a matter of will or an investment in high technology. Instead, it requires a number of key factors to be in place for success. If these factors are not in place, then the commercial practices discussed in the previous chapter simply will not work. In this case, training personnel in commercial practices is of no value, since the practices won't work regardless of how much training is given. This chapter begins by summarizing two research efforts, one looking at transportation for a government agency, and the other examining JIT purchasing. Each factor is then discussed in greater depth.

A. IMPROVING SHIPPING AT THE DEPARTMENT OF ENERGY

The United States Department of Energy (DoE) commissioned the University of Maryland to conduct a study to search for ways to improve shipping operations. The study originated from projected increases in DoE packaging, processing, shipping, and delivery requirements. After compiling the results of extensive database searches and in-depth interviews, this study found the following four elements most critical for success (University of Maryland, 1993, p. 12):

Long-term partnerships between carriers and shippers....This reflects the trend in logistics away from transactional exchange and toward relational exchange in transportation management.

Second, ... carrier quality programs that operate through both pre-qualification and on-going performance metrics to incorporate safety, performance, value, compliance, and process improvement into logistics management

Risk management ranked third ..., and included risk identification, analysis, reduction, and communication

Information systems management was the fourth ranking Critical Success Factor. Information flow is the key to many other factors, including quality programs, risk management, performance measurement, and relational exchange.

The identified factors are the antithesis of many past American business practices, and require significant cultural change. Long term relationships and carrier quality evaluations go against the idea of "all shippers are the same, so go with the lowest bidder." Now companies must work together and trust each other in a combined effort to lower costs. Risk management requires different corporate functions such as marketing, production, and finance to work together with logistics to find, analyze, and reduce risk. This is a marked improvement from the attitude of "That's a distribution problem, let the shipping department figure it out." In some companies, free flow of information was considered a threat, and managers would bottleneck information as a means of holding power over their subordinates. Now, e-mail and Electronic Data Interchange (EDI) result in a vastly higher volume of information going around bottlenecks.

B. GOALS AND CHARACTERISTICS OF JUST-IN-TIME PURCHASING

Heizer and Render analyzed JIT purchasing in their operations management text (1996, p. 541-545). They concluded that the goals of JIT purchasing are:

1) *Elimination of Unnecessary Activities.* For instance, receiving activity and incoming inspection activity are unnecessary under just-in-time. If purchasing personnel have been effective in selecting and developing vendors, the purchased items can be received without formal counting, inspection, and testing procedures....Production can contribute by providing accurate, stable schedules, adequate lead time for engineering changes to be implemented, and time to develop ethical suppliers.

2) *Elimination of In-Plant Inventory.* Virtually no raw material inventory is necessary if materials that meet quality standards are delivered where and when they are needed....Reduction or elimination of inventory allows problems with other aspects of the production process to be observed and corrected.

3) *Elimination of In-Transit Inventory*....Modern purchasing departments address in-transit inventory reduction by encouraging suppliers to locate near the plant and support rapid transportation of purchases. The shorter the flow of material and money in the resource "pipeline," the less inventory....

4) *Quality and Reliability Improvement*. Reducing the number of suppliers and increasing long-term commitments to suppliers tends to improve supplier quality and reliability. Vendors and purchasers must have mutual understanding and trust.

Heizer and Render then categorized JIT as applied to a corporate purchasing function into four principal areas. Their first finding was that to successfully implement JIT, a firm needed to develop long-term relationships with a small number of suppliers enabling both companies to remain competitive. Stable demand in small quantities formed the basis of their second principal area. The third finding was that quality is best improved by reducing specifications and using statistical process control, not post-production inspection. Finally, they found it vital that a company be able to control and schedule its shipping, particularly for inbound freight. Heizer and Render's findings are summarized in Table 6.

C. DISCUSSION OF KEY FACTORS

1. Stable Demand

Commercial logistics practices work best with a stable, predictable demand pattern. Regular demand patterns produce less uncertainty, which enables both supplier and purchaser to effectively plan for the future to maximize productivity while minimizing cost. Consequently, frequent deliveries in small lot sizes are possible. This minimizes the in-plant inventory, and reduces stockage costs. Heizer and Render (1996, p. 579-581) cover these points, noting that:

To achieve just-in-time inventory, managers *reduce variability caused by both internal and external factors*. Inventory hides variability - a polite word for problems. The less variability in the system, the less inventory is requiredThe key to JIT is producing small lot sizes to standards.

Characteristics of JIT Purchasing
Suppliers Few suppliers Nearby suppliers or clusters of remote suppliers Repeat business with same suppliers Active use of analysis to enable desirable suppliers to become/stay price competitive Competitive bidding mostly limited to new purchases Buyer resists vertical integration and subsequent wipe out of supplier business Suppliers are encouraged to extend JIT buying to <i>their</i> suppliers
Quantities Steady output rate (a desirable prerequisite) Frequent deliveries in small lot quantities Long-term contract agreements Minimal paperwork to release orders Delivery quantities variable from release to release but fixed for whole contract term Little or no permissible overage or underage of receipts Suppliers encouraged to package in exact quantities Suppliers encouraged to reduce their production lot sizes (or store unreleased material)
Quality Minimal product specifications imposed on supplier Help suppliers to meet quality requirements Close relationship between buyers' and suppliers' quality assurance people Suppliers encouraged to use process control charts instead of lot sampling inspection
Shipping Scheduling of inbound freight Gain control by use of company-owned or contract shipping and warehousing

Table 6. Characteristics of JIT Purchasing (Heizer and Render, 1996, p. 542)

Reducing the size of batches can be a major help in reducing inventory and inventory costs.

Toshiba has made great strides in reducing lot size. They utilize a process called Single Minute Exchange of Dies (SMED) that enables them to rapidly shift production from one item model to another, providing tremendous flexibility. Toshiba president Fumio Sato stated that (Heizer and Render, 1996, p. 587):

Customers wanted choices. They wanted a washing machine or a TV set that was precisely right for their needs. We needed variety, not mass production, says Sato. The key to variety is finding ways to make money from ever-shorter production runs. Sato urges managers to reduce setup times, shrink lead times, and learn to make more products with the same equipment and people Usually, they make a batch of 20 before changing models, but Toshiba can afford lot sizes as small as 10. Product life-cycles for low-end computers are measured in months, not years, so flexible lines allow the company to guard against running short of a hot model or overproducing one whose sales have slowed. The results are less inventory, less space devoted to inventory, less obsolete inventory, lower holding costs, and a focus on the products currently in demand.

Though stable demand is desirable, it is not usually the case in real life. It is certainly not the case for the Navy, whose demand requirements are driven by national security concerns. Small lot sizes have great potential to reduce inventory, but they are not a panacea. This concept can increase transportation costs since there are more shipments of material. Also, it requires suppliers who are capable of producing an item on short notice.

2. Low Stock Out Cost

Commercial logistics practices work best when the potential dollars lost from being out of stock on an item are relatively low. An example is a clothing retailer, who might convince a customer to purchase another item or to back order the desired good, knowing that the logistics system can quickly respond. Substitutability of products helps, because a company could use another supplier if one was out of stock.

An example of how a high stockout cost hampers implementation of commercial logistics practices comes from the airline industry. An airliner that is not mission capable can cost tens of thousands of dollars per hour in lost revenue, so quick response is a must. Jim Stansbury, the Team Leader for Corporate Contracts at DSCR, examined Boeing and General Electric (GE) inventory practices for jet engines. GE uses the commercial logistics practices discussed in this research, holding minimal stock and turning over its inventory ten times per year. Boeing uses a more traditional inventory system with high quantities of material on hand, and an inventory turn of .5 per year. In 1992, Boeing's SMA was a consistent 99%, with delivery occurring in under 24 hours anywhere in the

world. GE's SMA ranged from 80-85%. Customers could not afford the low SMA that GE's commercial logistics practices provided, so they have increasingly turned to Boeing. Since 1992, GE has substantially increased its inventory in an effort to boost its SMA and keep customers. (Stansbury, 1996)

3. Long Term Relationships with a Small Number of Suppliers

Developing long term, close relationships with good suppliers is essential to success. Reduced inventory means more frequent deliveries and a heavy reliance on both the supplier and the distribution system. Leading edge companies evaluate suppliers based on quality and their demonstrated ability to meet delivery schedules.

Open, two-way communication is critical to developing the mutual trust and respect needed in a long term relationship. Buyers frequently share production or operations schedules with a supplier, so the supplier can anticipate buyer needs. Sharing information reduces variability and response time. Some companies go further, integrating suppliers directly into their logistics system. Support can include training, engineering and production assistance, and even work spaces inside the buyer's facilities. Buyers and vendors consider themselves as colleagues working together. This kind of arrangement enables both firms to maximize profit. Contracting costs are virtually eliminated, and administrative and inventory costs are sharply reduced. As Heizer and Render (1996, p. 536-539) point out:

Viewing the supplier as an adversary is counterproductive A healthy vendor relationship is one in which the supplier is committed to helping the purchaser improve its product and win orders. Suppliers can also be a source of ideas about new technology, materials, and processes Likewise, healthy relationships also include those in which the purchaser is committed to keeping the supplier informed of possible changes in product and production cycle A good supplier relationship is one where both partners have established a degree of mutual trust and a belief in the competence of each other.

Firms have found that it is better to create partnerships with a few good suppliers rather than having a large number of suppliers who compete against each other.

Reducing the number of suppliers reduces variation in the process, improving product quality and enhancing the opportunity to foster a mutually beneficial relationship. Heizer and Render (1996, p. 539) state that:

Companies around the country are cutting back the number of suppliers by as much as 90%. They are demanding higher levels of service and product quality from the survivors. And they are willing to pay a premium on the theory that getting things right initially is cheaper in the long run.

According to Heizer and Render, Xerox has cut its number of suppliers by 90%, Motorola by 70%, General Motors by 45%, Ford by 44%, and Texas Instruments by 36%.

4. High Quality Products

Quality is the ability to consistently meet or exceed customer expectations. Top quality is a necessity to realize the benefits of commercial logistics practices. Commercial firms employ a variety of techniques to improve quality, including statistical process control to reduce variation, continuous process improvement, and Total Quality Management (TQM). Heizer and Render (1996, p. 86) note that:

Better quality means less inventory and a better, easier-to-employ JIT system. Often the purpose of keeping inventory is to protect against poor production performance resulting from unreliable quality. If consistent quality exists, JIT allows us to reduce all the costs associated with inventory.

There is a disadvantage to relying on a supplier's quality. Since commercial logistics systems frequently operate with minimal inventory, there is no safety stock to replace defective units. Poor quality in just one item can shut down an entire production line.

5. Integrated Information Systems

Information technology is the foundation for several logistics practices. Companies must know exactly what inventory they have, where it is, and where it's going if in transit. Leading edge firms focus on integration across supply channels to build operating links with partners, suppliers, customers, and carriers. Information systems

reduce the need for inventory and eliminate redundancy in procurement. In an article on managing logistics in the 1990s, Andersen Consulting (Capacino, 1990, pp. 4-5) stated that:

Companies cannot effectively manage costs, provide superior customer service, and be leaders in logistics performance without leading-edge information systems. Advanced logistics systems involve three aspects.... First, timely and accurate information is essential. This requires source data capture...and real time information processing capabilities. For example, a warehouse worker should not have to send pick documents to an office for key-punching and batch processing, but should scan or keypunch each transaction as it occurs

Second, integrated applications software with full functionality is a key part of an effective logistics information system. Full functionality will differ for each company but may include capabilities such as the ability to allocate inventory to a specific customer or lot traceability.

Third, advanced decision support is an important part of a logistics information system. Capabilities in this area include logistics network planning models which allow a what-if simulation of the cost and customer service impacts of alternative logistic network structure and policies; routing and scheduling analytic programs which can be used to reduce transportation costs; order consolidation programs that can design the best shipping strategies; and analytic software to evaluate alternative inventory deployment and management strategies.

An example of a company that has improved its inventory receiving function through information technology is Frank's Nursery & Crafts in Detroit. The company:

... implemented a portable voice system that directs workers through receipt verification and assignment of storage location. Data collection is by voice and barcode scanners. All information is exchanged in real time by radio frequency between the voice system and the dedicated personal computer managing the information In addition to significantly improved inventory accuracy, the new automatic data collection system immediately improved worker productivity 30% The system paid for itself in only 13 months.... Workers are guided through ... verification steps by voice prompts generated from the system. Because receiving at Frank's is a decision-tree process, over 100 potential voice prompts are pre-programmed Following the prompts, workers then collect data as

required using either voice data entry or bar code scanning. (Cahners Publishing Company, October 1994)

6. Competitive Environment Motivated by Profit

The commercial sector is fiercely competitive. Companies that do not provide top-quality products and service may quickly find themselves out of business. This fierce competition ensures that companies keep up to date in capability and remain competitive on price. The logistics function in many companies is evaluated by its contribution to the firm's profitability. This leads many companies to seek ways to reduce inventory without compromising customer service, since excess inventory is expensive to maintain and subject to obsolescence and pilferage.

7. Centralized Shipping Near to Corporate Headquarters

To receive the most benefit from a logistics system, it should be centralized near the strategic apex of the company, so the firm can integrate logistics into the strategic planning process. Centralization enables a company to maintain tight control while consolidating shipments and lowering costs. The University of Maryland (1993, p. 9) surveyed 20 companies seeking best logistics practices and found that all of them had

centralized their strategic logistics management function in proximity to the corporate center. This pattern contributed to company-wide planning and organizational activities. All cited increased control, improved efficiencies, and lowered costs as the primary motivations behind their centralization philosophy.

They gave the example of Pfizer Pharmaceutical (p. 9):

Pfizer discovered that by centrally pooling shipping demand, consolidating freight, streamlining administrative procedures, and integrating its information systems, its logistics function could be more productive while achieving considerable savings. Company-wide carrier rates were established through negotiations and corporate policies. Using the buying power gained from aggregated demand, they were able to [get] a lower national rate from Yellow Freight Systems than the individual business

units had managed to achieve. Procurement costs also fell as economies of scale allowed higher discounts and lower unit prices.

D. SUMMARY

This chapter has shown some of the prerequisites for implementing commercial logistics practices. It has demonstrated through a host of examples that implementation requires careful planning and a specific set of key factors. It has also shown that some of these logistics practices can be detrimental if applied incorrectly. The author cannot emphasize strongly enough that if these factors are not in place, all the personnel training in the world will not make these commercial practices work. The next chapter looks at whether DoD's operating environment has the characteristics necessary to implement commercial logistics practices.

VII. DIFFERENCES BETWEEN THE NAVY AND THE PRIVATE SECTOR

Navy inventory management differs from the commercial sector in several respects. This chapter discusses some of the factors contributing to these differences. Many of these factors inhibit the Navy from behaving like a commercial firm and adopting commercial logistics practices. Because of these differences, training in commercial logistics practices would serve no purpose, since the environment necessary for its implementation is not present.

A. UNPREDICTABLE DEMAND

Unlike the commercial sector, Navy inventory requirements are driven by national security commitments. There is no forecasting model that can predict next year's demand for the Navy's services. Since foreign crises frequently flare up with no warning, each one is a "Come as you are" situation. The military must be in a constant state of readiness. Many critical components used in Navy weapons systems have lead times of over a year that cannot be significantly reduced, even with additional funding. A wartime inventory model is completely different from that of peacetime. As a result, the Navy must maintain stocks of items it may never use as insurance against the threat of a foreign crisis.

B. HIGH STOCK OUT COST

In the commercial sector, the cost of a stock out can be estimated in dollars, derived from a combination of lost revenue, back ordering costs, and lost customers. This is not the case for defense items. Naval forces must be ready to respond on a moment's notice to a crisis anywhere in the world. The cost of running out of stock on an item is sometimes measured in lives, perhaps even thousands of lives.

**C. INEXPERIENCED FLEET PERSONNEL WITH HIGH TURNOVER
INHIBIT THE NAVY'S ABILITY TO FORM LONG TERM
RELATIONSHIPS WITH SUPPLIERS**

In the commercial sector, inventory management personnel typically remain in the same job for several years, and often stay in the same location for their entire career. A similar situation exists at NAVICP. However, this is not true in the operating forces. The typical fleet sailor is 21 years old. Personnel turnover on most ships and stations is over 25% per year. Promotion is rapid compared to the private sector. Personnel rapidly rotate through different tasks in order to acquire a variety of skills. Consequently, sailors do not develop in-depth experience in any one facet of logistics. The combination of youth, inexperience, and rapid turnover makes it next to impossible to develop long-term relationships with suppliers.

Formulating an inventory management training policy for these personnel is difficult. There are a myriad of job tasks to which AK and SK personnel might be assigned. In addition, newly reported junior enlisted typically spend 90 days in a Temporary Additional Duty (TAD) billet such as food service or laundry before commencing work in their rate. Consequently, comprehensive formal training shortly after completion of recruit training would most likely be wasted, since it would cover many topics the sailor would never utilize, while other topics would be forgotten before the new sailor would be able to put them to productive use.

**D. GOVERNMENT CONTRACTING REGULATIONS INCREASE
INVENTORY BY INHIBITING THE DEVELOPMENT OF LONG-TERM
RELATIONSHIPS WITH SUPPLIERS**

Government contracting is quite different from commercial sector contracting. It is a highly regulated process defined by law, judicial decisions, and internal policies. Government purchasing agents serve as stewards of public funds, and are subject to high

accountability. Government contracting does not exist merely to buy goods for the government. It also tries to ensure equity in contract awards, and to promote social goals. Unfortunately, the objectives of government contracting frequently conflict with the concept of efficiency, and preclude the adoption of commercial logistics practices.

Under the Competition In Contracting Act (CICA) of 1984 and the Federal Acquisition Regulations (FAR), government contracting operates on the premise of "full and open competition." This essentially means that every contract is up for grabs to any firm that desires to bid on it. While competition in itself is desirable in producing better quality at a lower price, the government approach to competition can be deleterious. There is often no continuity from one contract to the next, even for the same item. Consequently, "CICA requirements for open and full competition may be considered an obstacle to the government's ability to establish and maintain commercial-like relationships since most contracts awards are competed individually with no commitments for future follow-on business (DSMC, 1991, p. 3-4)." The government's requirement for a rigid, formal contracting process also works against the adoption of commercial contracting practices:

In order to promote and realize fairness and equal opportunity in the government contracting process, the government relies on very specific rules, regulations, and procedures in order to eliminate subjective bias in the expenditure of public funds. Formal rules are also necessary due to the numbers of personnel involved in government contracting and their turnover rate. This environment and the resulting practices are in direct contrast to an attitude of cooperative contractual agreements between buyers and sellers in the commercial sector. (DSMC, 1991, p. 5-3)

As a result of the government's insistence upon full and open competition, Navy inventory levels are higher. Since most government contracts are awarded individually, the length of time required to complete them does not decrease over time. This process is quite long, as it involves determining the requirement, setting specifications, writing a voluminous contract, soliciting and evaluating bids, awarding the contract, and dealing with protests. Despite recent reform under the Federal Acquisition Streamlining Act

(FASA) of 1994, the tremendous volume of paperwork and regulations involved in government contracting make it nearly impossible to reduce cycle time, consequently requiring inventory levels to remain relatively high because of long replenishment time.

E. GOVERNMENT CONTRACTING REGULATIONS OFTEN RESULT IN POOR QUALITY, INCREASING INVENTORY REQUIREMENTS

Contracting regulations can sometimes drive the government to purchase poor quality items. Although the government has a concept called “best value” which states that factors other than price should be considered in making a source selection, many government contract awards are still price-driven. This is penny wise and pound foolish, because added reliability or quality may well be worth a slightly higher price. FASA emphasized best value as an attempt to put common sense back into the procurement process. The full impact of FASA has yet to be felt.

At present, the concept of “Full and open competition” on every bid does not give adequate weight to a contractor’s past performance in technical merit, reliability, and ability to deliver on schedule. As long as a firm can barely meet the minimum requirements to produce an item, it cannot legally be prohibited from bidding. A firm’s past willingness to cooperate in resolving disputes and ambiguities is rarely considered as an evaluation factor (DSMC, 1991, pp. 3-4, 5). The government cannot boycott uncooperative companies or place most of its business with more responsive firms (p. 4-3). As a consequence of these factors, there is no incentive for a vendor to provide the best product or service.

Some of the social goals of government contracting result in awarding contracts on the basis of race, gender, or company size rather than on quality or past performance. This can result in lower quality firms and products being selected. It can also result in higher prices, or in purchases from a company in financial trouble that may not be in business when spare parts or technical assistance are needed.

Contracting regulations also reduce the number of firms that will bid on an item. This indirectly reduces quality by limiting competition. Government regulations dictate that a firm must offer its "best customer price" to the government. The problem with this idea is that firms give their best customer price based on a mutual relationship of long-term commitment and cooperation. The government demands to be treated as a best customer without being willing to behave as one (DSMC, 1991, p. 5-4).

Delays in payment and litigation are also an obstacle. The government not only demands the lowest price and resultant lowest profit margin, it is also frequently the last customer to pay, and the most likely to initiate litigation. Given this situation, it is understandable why many firms refuse to bid on government contracts, even if they could supply better quality products at lower prices than the eventual contract winners. (DSMC, 1991, p. 4-4)

Another way that the government reduces competition is by insisting on far more information than the commercial sector:

The government generally requires more documentation, such as user and maintenance manuals and schematic drawing packages, than is normally produced with commercial products. Generating these documents is usually a distraction for the supplier, since people are diverted from their usual work activities to develop them. Additionally, they are reluctant to provide detailed technical data about their products for fear of revealing competitively advantageous information. Unless a firm is in business to produce technical documents, requesting them in addition to what is normally provided with a product in different form or format discourages vendors from selling their products to the government. (DSMC, 1991, pp. 5-3, 4)

The government will frequently ask for data rights detailed enough to enable it to competitively rebid subsequent contracts. Companies with specialized techniques and processes will often refuse to bid on government contracts, since they would be giving away trade secrets. The government also insists on cost and pricing data for contracts over \$500,000. This practice has no counterpart in the commercial sector, and in fact this information is often considered proprietary. (DSMC, 1991, p. 5-4)

“Government warranties are usually different from the commercial warranty normally offered with the product, although not necessarily more comprehensive.” (DSMC, 1991, p. 5-5) In addition, the large volume of paperwork involved in government contracting often discourages vendors from bidding:

When the government acquires an item from a commercial supplier, the contract usually developed is enormously detailed and complex compared to commercial contracts for similar items. The government attempts to protect itself from all conceivable contingencies through the incorporation of multitudinous and voluminous contract clauses. These clauses, which are used to ensure that the government receives a quality product at a fair price, are often in direct conflict with standard commercial practices and the Uniform Commercial Code. (DSMC, 1991, p. 5-2)

In summary, the limited profit, late payment, lack of commitment for future business, requests for proprietary information, and award of contracts based on criteria other than price and quality all inhibit bidders. By reducing the number of competitors, the government indirectly reduces the quality of items it purchases. The lack of follow-on business means there will be high variability between an item bought on one contract and the same item bought on a subsequent contract. If a delivered item is substandard, it may be months before a new contract is let to procure the same item. Consequently, the Navy needs higher inventory levels to compensate for the unpredictable quality of items it purchases.

F. LACK OF ASSET VISIBILITY RESULTS IN REDUNDANT INVENTORIES

The Navy's inventory information system cannot access information on all items used by the Navy. It cannot read information on the DLA SAMMS database, the Army CCSS or SARSS inventory databases, or the USAF database. This can result in redundancies, where inventories of joint service items are maintained by both services.

The services are making a significant effort to improve this deficiency. Lt. Gen Cusick, the Joint Staff Logistics Chief (J-4), discussed the Joint Total Asset Visibility (JTAV) initiative with the author. The Army is the lead service for JTAV, whose goal is to provide interoperability among currently stovepiped inventory systems. When fully implemented, JTAV will provide asset visibility "from the factory to the foxhole." The intent is threefold:

- 1) JTAV will enable consolidation of stock points. Inventory managers can then reduce total inventory and cost, while improving response time. Without JTAV, "You can't manage what you don't know you have" (Cusick, 1996)
- 2) JTAV will improve customer confidence in the supply system. When a field unit can electronically track its requisition all the way to the factory, supply personnel are less likely to hoard the item or order multiple times for the same requirement.
- 3) JTAV will enable all services to purchase items held by another service, linking the currently stovepiped accounting systems.

According to Lt. Gen Cusick, to meet these goals JTAV must be able to fulfill the following five requirements:

- 1) Collect the data, preferably electronically through automated tags and laser cards.
- 2) See the data, providing visibility across service boundaries.
- 3) Use the data by enabling inventory managers to divert shipments and draw upon other service's resources.
- 4) Provide help in interpreting the data. This encompasses Decision Support Systems, as well as help in finding substitute items and lost requisitions.
- 5) Model the data through a Global Command and Control System (GCCS) that would enable war gaming and simulation.

An estimated implementation date for JTAV is not yet set.

G. MONOPSONY INCREASES INVENTORY BY REQUIRING THE CUSTOMER TO STORE A LARGE PRODUCTION RUN

Monopsony is an economic term meaning "One customer." This situation is inevitable for many defense items, since the exclusive use of the latest weapons and their support systems provide the United States with a competitive edge on the battlefield. This situation results in the Navy being the only purchaser for many weapons systems. JIT inventory systems are then impractical because JIT requires frequent delivery of small lot sizes, which would leave a manufacturer's production line idle much of the time. Under monopsony, an item's manufacturer is only going to make the item once or infrequently, and will be serving other customers at the same time. The manufacturer may be the only supplier of an item, but this firm can and usually does have other customers for other items. It only makes sense for the manufacturer to want to produce a large lot size and then utilize its production resources on other items. This increases the sole customer's inventory, since it must hold more inventory than it would normally purchase in a competitive market environment composed of many customers.

While monopsony is unavoidable for weapons systems, it is not necessary for many secondary items such as spare parts, clothing, and medical supplies. However, government regulations sometimes drive secondary items into this situation, resulting in the government being the only buyer for an item. The following four cases pinpoint how this can happen:

- 1) "The government's use of detailed specifications often limits the number of potential solutions to a stated need...relative isolation of the writers of military specifications from users, buyers, and the marketplace. The result is a breakdown in understanding user requirements and what is available in the marketplace." (DSMC, 1991, p. 2-5)
- 2) In addition to the writers of specifications, "Acquisition personnel are not usually trained in how to conduct market research, surveys, and analyses. (DSMC, 1991, p. 2-6)" Consequently, they may be unaware of how to find potential solutions to a need without procuring a government-unique item.

3) Government contracting sometimes functions on the exact manufacturing process to be followed, rather than on form, fit, and function. A commercial item with the same or better performance characteristics might be rejected because a specific process was not followed.

4) There is a cultural bias in DoD to favor new items over those available commercially:

Another factor is DoD's propensity to favor (issue) guidance for new developments while providing relatively little guidance for procuring existing items. With minimum guidance to government buyers and a natural inclination to believe one's own requirements are unique, the default *modus operandi* is to go for new development rather than take time to determine whether or not something already exists that could satisfy the requirement. (DSMC, 1991, p. 2-6)

H. GOALS AND PERFORMANCE MEASURES EMPHASIZE READINESS AND REWARD KEEPING HIGH LEVELS OF INVENTORY

The commercial sector has the goal of satisfying customers by producing and delivering goods that are high quality, low cost, and quickly delivered. Logistics managers are rated on efficiency and response time. Although high inventory can improve response time by making sure goods are always available, it is costly and subject to obsolescence and pilferage. In the commercial sector, high levels of inventory are seen as an unnecessary, expensive liability.

In contrast, Navy commanders are evaluated in terms of readiness to perform their operational mission. The Navy supply system supports readiness by evaluating item managers in terms of SMA, number of back orders, and ACWT. High levels of inventory improve all of these measures, and can be seen as insurance against unforeseen circumstances.

I. GEOGRAPHIC DISPERSION INCREASES REPLENISHMENT TIMES AND INVENTORY REQUIREMENTS

United States international commitments require Navy operating forces to be deployed worldwide. It is simply not possible for the users to be geographically close to their suppliers. Also, the government's insistence on full and open competition means that any firm in the country can bid on a contract. These factors increase inventory requirements since the replenishment time is longer.

J. SEPARATE SERVICE TRANSPORTATION NETWORKS INCREASE COSTS AND INVENTORY

All four armed services and DLA maintain their own transportation networks. These separate networks cannot see each other's assets or cargoes. Consequently, economies of scale and centralized control are not realized. This arrangement negates the advantages that could be gained by maintaining a common logistical system under one command. Inventories must be higher because the separate networks are not as efficient as a consolidated system would be.

K. SUMMARY

This chapter has shown some of the major differences between the Navy and the commercial sector that relate to inventory management. It has demonstrated that these differences frequently preclude the use of commercial logistics practices. Consequently, training personnel in commercial logistics practices would be pointless, since the factors necessary for implementation are not present. The next chapter examines whether training in commercial logistics practices could rectify the causes of excess inventory identified in Chapter II.

VIII. IMPACT OF TRAINING IN COMMERCIAL LOGISTICS PRACTICES UPON NAVY EXCESS INVENTORY

This chapter defines training, examines the role of training in changing organizational culture, and discusses whether training in commercial logistics practices would rectify the causes of excess inventory identified in Chapter II. For each cause of excess inventory, the impact of training in commercial logistics practices is discussed. Current DoD initiatives to improve inventory management are correlated with the cause of excess to which they apply. The findings are then summarized in a table.

A. DEFINITION OF TRAINING

There are a number of different ways to define training. Michael B. McCaskey in an article in the Harvard Business Review refers to training as the systematic acquisition of attitudes, concepts, knowledge, roles, or skills that result in the improved performance of work (McCaskey, 1995, p. 175). Mintzberg considers training and behavior formalization synonymously with achieving standardization. According to Mintzberg, training is the use of formalized instructional programs designed to establish and standardize in people the requisite skills and abilities for particular jobs in organizations. Behavior formalization is the system of rules, job descriptions, regulations, and evaluations imposed by the manager to control and evaluate performance. Combining the two provides a level of standardization that guides behavior toward desired outcomes (Mintzberg and Quinn, p.335). Organizations train their employees to increase the performance of their people and achieve a competitive advantage.

B. EFFECT OF TRAINING ON ORGANIZATIONAL CULTURE

Many other factors besides training must be considered when trying to change organizational culture and behavioral norms. One of the most widely used models of

organizational behavior is that of Michael B. McCaskey of the Harvard Business School. Figure 8-1 is a graphic depiction of the McCaskey model as modified by Nancy Roberts, Professor of Management at the Naval Postgraduate School (Roberts, 1996). The McCaskey model first sets an organization within a context largely shaped by external factors. This context is then woven together with top management vision and industry-specific key success factors to drive the organizational design. There are five organizational design factors: task requirements, organizational structure, technology, people, and process/systems including training. The combined effect of these five factors drives the organizational culture and management style, which then leads to outputs and outcomes.

Organizational culture, including the prevalent norms and values within the organization, is beyond the direct control of top management. According to McCaskey, culture is the combined output of all five of the organizational design factors. Since training is only one portion of one of the design factors, a change in training may have little or no impact upon organizational culture and behavior. The five design factors are internal parameters that are under the direct control of management, but are shaped by the historical and external context of an organization.

The McCaskey model represents a dynamic system where a change in any part of the model can lead to changes throughout the entire process. These changes may result in differing productivity, quality, employee satisfaction, and outcomes. They may either be positively reinforcing to strengthen behavior or negatively reinforcing leading to behavior opposite of that intended. In order to achieve a desired cultural change, all of the organizational design factors must be considered and balanced against one another.

In the McCaskey model, training is not the driving factor in cultural change. Training is merely an enabler that conforms personnel to a culture that already exists. Consequently, training has not proven effective as a vehicle for changing a culture. Without altering the other organizational design factors, changes in training by themselves are unlikely to have much effect upon organizational culture and behavioral norms. Training is also ineffective in changing behavior when the source of the behavior

**THE DESIGN FACTORS &
HOW THEY INTERACT
ARE SHAPED BY**

ORGANIZATION DESIGN FACTORS

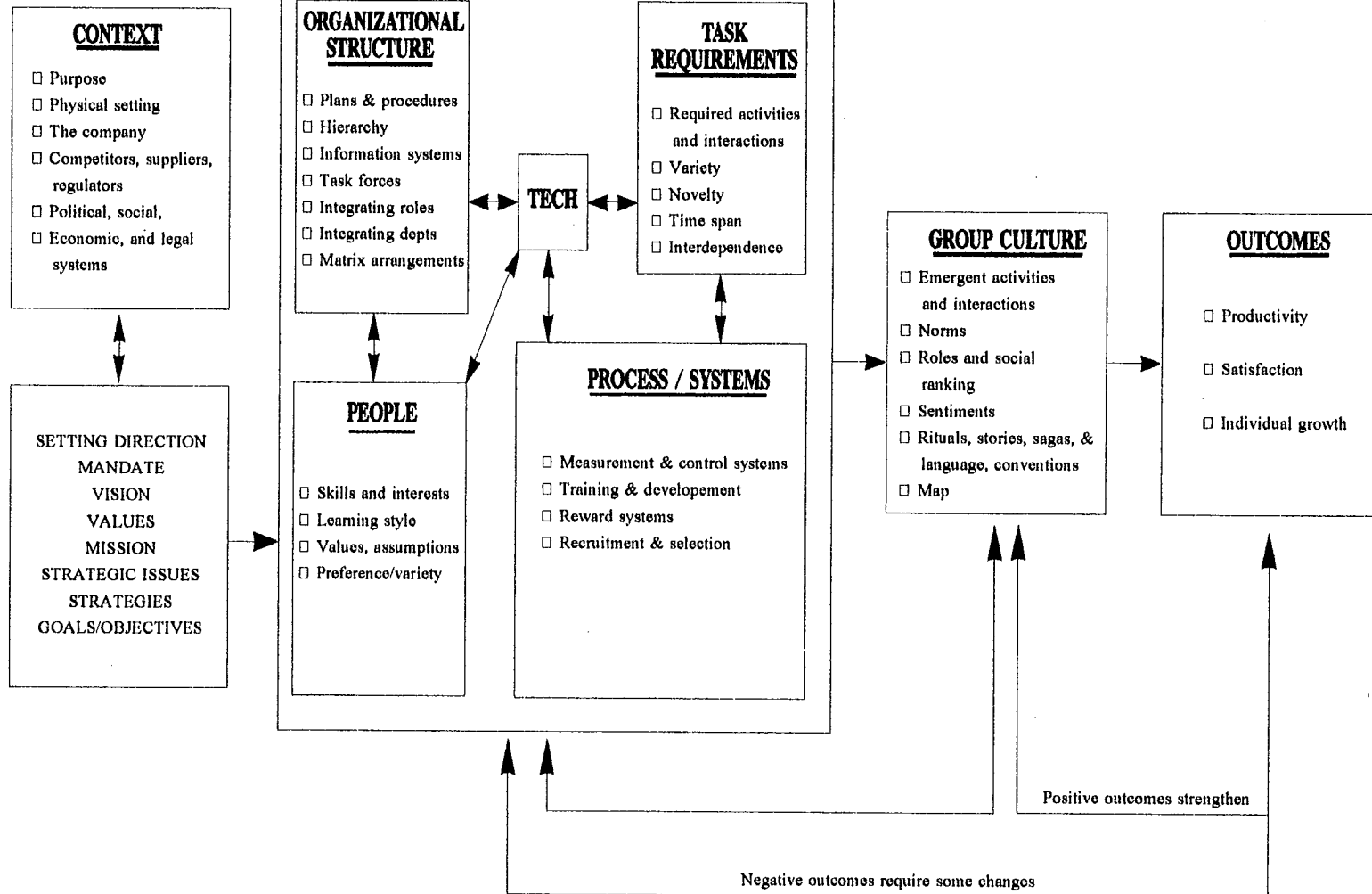


Figure 8-1 The McCaskey Model as Modified by Roberts

stems from the external context of an organization. In such a situation, training has little or no impact on culture.

C. IMPACT OF TRAINING UPON THE CAUSES OF EXCESS INVENTORY

Many of the causes of excess inventory are beyond the control of the item manager and fleet personnel. Because of this, training personnel in commercial logistics practices would produce little or no change in their behavior. In some cases, utilizing commercial logistics methods could be negatively reinforced by the current organizational structure and rewards system. The following paragraphs detail the impact of training upon each identified cause of excess inventory:

1. Decrease in Requirements

Decreases in requirements for an item can result in excess inventory when there is enough material on hand to support the older, higher requirements. A decrease in requirements can result from the weapons system being phased out, reliability improvements, a change in operational use, reduction in repair cycle time, reduction in administrative or production lead time, a reduction in war reserve requirements, or items ordered for a contingency that does not materialize. Most of these causes are external to the context of NAVICP and DLA.

None of these factors would be affected by training in commercial logistics practices. In fact, POP and long term contracting arrangements might make this situation worse. Both reduce the administrative lead time needed for replenishment, thus more inventory would then be labeled as excess.

Training the NAVICP IWST and the weapons system Program Offices to understand each other's priorities and anticipate each other's operations, coupled with improved communication between the two offices, might reduce the generation of excess inventory. For instance, if a Program Office knows the schedule at which a weapons systems will be phased out, they could communicate this to the NAVICP IWST, possibly reducing or averting a procurement action. If the fleet has now changed the operational

use of an item reducing its demand, the same scenario applies. If IWSST equipment specialists know of reliability improvements that should reduce demand, NAVICP could reduce initial procurements and communicate this to the Program Office. By working together, these two groups could eliminate the deleterious impact of their actions upon each other.

2. Receiving the Wrong Consumable Part

There are two basic causes of receiving the wrong part: ordering it incorrectly or having the supply activity pick the wrong item off the shelf. A unit may order the wrong part because of a keypunch error, or poor manuals or technical assistance. A supply activity may have inaccurate stock location files that could result in parts being out of their proper location.

Training in commercial logistics practices would not resolve this cause of excess. None of the commercial practices apply if personnel are ordering the wrong part or have inaccurate data files. Basic procedural training might reduce the frequency of ordering the wrong part. As discussed in the previous chapter, comprehensive formal training will most likely be forgotten before it is put to use. Given the dynamic and diverse nature of AK/SK fleet job assignments, ongoing unit level training would be best suited to resolve this problem.

Microchip Technology for Logistics Application/ Radio Frequency (MITLA/RF) is an electronic tracking system that records the precise identification of items by radio frequency inventory. This has the potential to detect if the part being shipped does not match the requisition. However, if the part is tagged incorrectly, MITLA/RF would not help.

3. Lack of Asset Visibility

An inability of the Navy, DLA, and the other services to see each other's inventories can result in redundancy. A service may buy an item which another service is holding unused in a warehouse (Department of Defense Joint Staff, 1996, p. 5).

Training would not help this situation in any way. There is a saying that "You can't manage what you can't measure," and that is certainly true here. As discussed in

the previous chapter, the services are on track to implementing JTAV. Until that becomes a reality, the lack of asset visibility will have the potential to generate excess inventory.

There are also differences in the services' accounting systems that need to be reconciled to enable cross-service purchases. The Defense Financial Accounting Service (DFAS) was created in 1991 to standardize policy and operations in service accounting systems. To date, it has reduced the volume of accounting regulations by 88%. DFAS intends to have all services using a common accounting system by 2002. Standardization and improvements wrought by DFAS will be included in JTAV.

4. Lack of Customer Confidence

Operating forces sometimes do not have confidence in the ability of the supply system to support them, so they hoard items, and deliberately order more than they need. This stems from a philosophy of "Readiness at Any Cost." A peacetime military is primarily evaluated in terms of readiness and unit commanders sometimes try to boost readiness through holding additional inventory.

Training could help this issue at the unit level. Supply personnel already know that reordering a part will not make it arrive any faster. Warfighters need to know the same information. Ideally, receiving acknowledgement that a requisition is in good status and being processed will stop multiple orders, and hoarding will be minimized. However, command influence will continue to make this cause of excess a problem until the supply system demonstrates that it can reliably meet the needs of deployed forces, and the culture of "Readiness at any cost" is changed.

JTAV has the potential to reduce this cause of excess. Having visibility of a command's requisitions "From the factory to the foxhole" (Cusick, 1996) should improve the confidence of operating units in their supply support.

5. Base Realignment and Closure (BRAC)

As force structures contract and bases are closed or realigned under BRAC, demand will decline and cause excess inventory. In addition, closing a base almost always results in identifying inventory that is not on the accountability records. This has happened repeatedly as DLA and the services have closed distribution depots.

There is no type of training that would reduce this cause of excess, since BRAC actions are external to the context of DoD. BRAC decisions are made by a bipartisan Congressional panel that tries to reduce the impact of the defense Drayton upon both the military and the civilian community. Reducing the generation of excess inventory is not a high priority for the BRAC commission when compared to their role in reshaping America's military.

Basic procedural training at the unit level may reduce the incidence of mis-identified stock in the future. Performing regular wall-to-wall inventories is vital to ensure that physical inventories match stock location records. However, this will not alleviate the excess inventory caused by poor identification in the past. MITLA has the potential to identify all inventory present in a warehouse and could pinpoint items not on an accountability list. However, if the part was tagged incorrectly MITLA would not help.

6. Support of Allies

Support of our allies sometimes forces the United States to hold items that appear to be excess. These may be from FMS contracts or from regional agreements. The United States often sells different configurations of a weapons system to different countries, and then must maintain inventory on each separate configuration. Nations that purchase United States weapons frequently do not purchase all of the necessary spare parts up front. Since the United States is the sole source for these items, DoD must maintain inventory, sometimes on weapons that United States forces no longer use. Regional agreements also result in the United States holding stock needed for the defense of another nation.

Training will not reduce this cause of excess. Support of allies is external to the DoD organizational context. Both FMS contracts and regional agreements are political issues that can only be resolved at the highest levels of the Department of State and Department of Defense. Maintenance of what appears to be excess inventory is sometimes necessary to support foreign policy objectives. No amount of personnel training will change political reality.

7. Poor Estimates of Support Required for Initial Procurement

When a new weapons system is fielded, the initial estimates of which components will break and how often come from the contractor in an Interim Support List (ILS). There is currently no incentive for the contractor to limit the size of the ILS, since they profit from each additional item they can include on it. The ILS is generated external to the context of DoD inventory management structure.

Training would not reduce the generation of excess from this cause. Contractor data drives the purchase of spare parts. Until real usage data supplants the ILS estimate over the course of several years of operational use, the Navy purchases based upon a contractor engineer's projections and guesses.

There is an initiative that might reduce generation of excess inventory from this cause. The Navy is developing a program under which the contractor would be responsible for all spare parts support for the first two to five years of a weapons system introduction. Only after sufficient operational demand data has been established would the Navy take over responsibility for weapons system parts support. This initiative would greatly reduce the generation of excess from a poor estimate of required support, since the contractor would have no incentive to increase the IS. (Waite, 1996)

8. Demilitarization

Old military equipment must be demilitarized before it can be either sold or disposed. The funding comes out of Operations and Maintenance (O & M) dollars, which are the same dollars the services use to pay for current operations. In this time of increasingly tight funding, there is simply not enough priority to pay for demilitarization of old equipment when the services need the money for today's operations.

Training would have no impact upon this issue. Demilitarization and its funding are external to the organizational context of DoD. The inability to demilitarize excess equipment is a budgeting problem, and no amount of training will resolve it.

9. Item Manager Incentives

A full discussion of item manager incentives is beyond the scope of this thesis.

This section will touch on how the performance measures used to evaluate item managers result in dysfunctional behavior. There is a saying that "That which gets rewarded gets done." The author's observation is that this maxim holds true in inventory management. NAVICP and DLA have tried many different performance measures throughout the years to evaluate item managers. These measures have resulted in behavioral changes, but have not improved the system to reach the desired goal of maximum readiness at minimal cost (Nixon and Wolfe, 1996). Table 7 shows some of the performance measures that have been used to evaluate inventory managers, and the resultant behaviors.

Performance Measure	Resulting Item Manager Behavior
Supply Material Availability (SMA)	Keep higher inventories
Average Customer Wait Time (ACWT)	Cancel documents that cannot be filled quickly
Number of Backorders	Cancel documents that cannot be filled quickly
Number of orders shipped	1) Split large orders into many small orders 2) Ship small orders first
Pounds of Material Shipped	Ship large or heavy orders first

Table 7. Performance Measures That Have Been Used to Evaluate Inventory Managers and the Resulting Behaviors

The primary measures of effectiveness of an item manager (SMA, ACWT, and Number of Backorders) all promote readiness and do not address the creation or retention of excess material. Both in the Navy and DLA, item managers perceive that the worst thing they can do short of breaking the law is to run out of stock on an item. (Brennan, Coyle, Panetta, and Pero, 1996, and Nixon and Wolfe, 1996)

Training in commercial logistics practices would not improve this situation. In fact, under the current DLA funding arrangement, JIT is discouraged because it costs more than traditional inventory methods. DLA activities have a transaction charge of roughly \$33 per line item, regardless of quantity. The frequent deliveries of small quantities with a JIT system can result in higher costs to the item manager. In addition, until recently there was little incentive to get rid of excess inventory. Since there was no storage cost to hold the material but a \$33 transaction charge to move it, item managers were incentivized to keep their excess.

In 1995, DLA began charging for covered storage at the rate of \$5.15 per square foot per year (GAO/NSIAD-95-64, 1995, p. 16). Non-warehouse storage is cheaper, roughly one dollar per square foot per year for shed storage and 30 cents per square foot per year for outdoor storage (Estes, Miller, Rosenberry, and Snyder, 1996). This measure has the potential to remove excess from storage, since it will be much more expensive to keep it than to transfer it to DRMO for reutilization.

10. Economic Considerations

Warehouses that hold part of the National Stockpile cannot sell or dispose of these items by law. In addition, selling some of these items has the potential to devastate markets that would be flooded by the abundant supply. Consequently, the military simply maintains its stocks of these commodities.

Training would not improve this issue in any way. The National Stockpile is a matter of public law that is completely external to the DoD organizational context. Only legislation can reduce this cause of excess.

11. Contracting Regulations

Unlike the private sector, the government must comply with the provisions of the Competition In Contracting Act (CICA) and other regulations designed to promote equity and social goals in government contracting. These requirements add months to the contracting process, thus increasing the reorder point since more stock is needed to cover demand during the replenishment period. The FASA of 1994 attempted to address this issue, but its effects have yet to be felt.

Training in commercial logistics practices has some potential to improve this area. There are several initiatives currently underway. One is the Navy's Prime Vendor program, where contractors are responsible for supplying and delivering all inventory to fleet centers. This program is currently in place to support all TH-57 Ranger inventory, as well as C-130 propeller blades.

Another active initiative is the Direct Vendor Delivery (DVD) program. This program has vendors ship items directly to the operating forces, without passing through a Navy or DLA warehouse. As of July 1996, 11 percent of DSCR requisitions and 22 percent of DSCR sales volume used DVD (Bailey, 1996).

Table 8 gives a brief synopsis of the findings of this section.

D. SUMMARY

This chapter has demonstrated that training in commercial logistics practices would have little impact on the excess inventories currently in DoD. The McCaskey model shows that training is only one of five organizational design factors in Defense inventory management. Training has limited utility in changing behavioral norms when the other factors of organizational design (task requirements, people, structure, technology, and processes/systems) remain unchanged. Training is most effective as an enabler to conform personnel to a culture that already exists. It has not proven effective as a vehicle for changing culture. Training is completely ineffective in changing behavior when the reason for the behavior comes from outside the organizational context.

This chapter has discussed the impact of training on the causes of excess inventory identified in Chapter II. Most of the causes of excess are outside the organizational context of DoD inventory management, and would thus be unaffected by training. Several other causes might be affected by some form of training, but not training in commercial logistics practices. Only in the area of contracting regulations does training in commercial logistics practices have some potential to improve Navy inventory management. The next chapter presents conclusions and recommendations.

Cause of excess inventory	Would training in commercial logistics practices reduce this cause of excess?	Would any type of training reduce this cause of excess?	If training would help, what kind of training, and to whom?
Decrease in requirements	No	Yes	Training IWST and Program Office to understand each other and work together
Receiving the wrong consumable part	No	Yes	Basic procedural training for fleet SK/AK
Lack of asset visibility	No	No	
Lack of customer confidence	No	Yes	Supply principles training for unit commanders
BRAC	No	No	Basic procedural training for fleet AK/SK may reduce this problem in the future
Support of allies	No	No	
Poor estimates of support required for initial procurement	No	No	
Demilitarization	No	No	
Item Manager incentives	No	Yes	Training Item Managers to understand the impact of their actions on the system
Economic Considerations	No	No	
Contracting Regulations	Yes	Yes	Long Term Contracting and Direct Vendor Delivery Training for Item Managers

Table 8. Impact of Training Upon the Causes of Excess Inventory

IX. CONCLUSIONS AND RECOMMENDATIONS

This thesis has examined the issue of whether training in commercial logistics practices would benefit Navy inventory management of secondary items. It has listed the primary causes of excess inventory; discussed how inventory managers at NAVICP, DLA, and in the fleet are currently trained; and examined how those inventory managers apply their training. The thesis then looked at commercial practices, the factors necessary for their implementation, and discussed whether these practices could be effective in a government setting. Chapter VIII then tied this information together, showing how the causes of excess inventory would in most cases be unaffected by training. Now follows the conclusions and recommendations of this thesis.

A. CONCLUSIONS

1. Training in Commercial Logistics Practices Will Not Significantly Improve Navy Inventory Management of Secondary Items

Most of the causes of excess inventory are unrelated to training. Issues such as a lack of asset visibility, lack of customer confidence, support of allies, demilitarization, BRAC, and economic considerations have no connection to the training of inventory managers. A training program in commercial logistics practices, no matter how well constructed, would have no impact on these causes of excess inventory.

Several other causes of excess might be affected by training, but not training in commercial logistics practices. The consequences of a decrease in requirements for an item might be partially averted by training the weapons system Program Office and NAVICP IWSST to understand each other's priorities and capabilities and to work together. Excess caused by receiving the wrong consumable part can be reduced with better on-the-job training of supply personnel in the fleet. Excess caused by poor estimates of support required for initial procurement can be alleviated with some of the initiatives discussed in the last chapter, such as making the contractor responsible for all

parts support for the first several years of a weapon's system introduction. This would of course need to be balanced against the national security risk involved in carrying a reduced inventory of spares for a first-line weapons system.

Only in the area of contracting regulations does training in commercial logistics practices have potential to reduce excess inventory. This cause of excess is largely self-inflicted, thus the government has the ability to change its policies to reduce the generation and retention of excess inventory. The FASA of 1994 reduced some of the burdensome requirements of government contracting, making it easier to buy quality products and develop long-term relationships. Prime Vendor and Direct Vendor Delivery are two initiatives currently underway that can reduce inventory.

2. Many Commercial Logistics Practices Are Simply Inappropriate for the Navy

Because of the tremendous differences between the Navy and the private sector, commercial practices such as JIT just will not work in the Navy. Factors such as unstable demand, huge stockout cost, and geographic dispersion preclude the use of many logistics practices that have proven so successful in the commercial sector. These factors cannot be changed, since they are inherent to being a military entity of a worldwide maritime power.

3. Organizational Culture Is Too Complex to Be Accomplished by Changing One Variable

Training is only one of the inputs to organizational behavior. An organization's basic design derives from its external context and its mission/ vision/strategy. Internal to the organization, training is combined with structure, reward systems, people, and management/control systems to produce the organizational culture, which then drives the outputs. Trying to alter a culture by changing only one of these variables is usually a wasted effort. In the case of inventory management, the current mission, structure, reward systems, and management and control systems all promote behaviors which do not reduce generation of excess inventory. If personnel were trained in using commercial

practices designed to reduce inventory, it would have little or no effect, because the other elements of organizational design oppose it.

4. DoD is on the Right Track with Many of its Initiatives

Many causes of excess inventory are beyond the ability of DoD to control. For those it can control, DoD has made good efforts to improve its logistical system. JTAV, DVD, and initiatives to make contractors responsible for the first several years of weapons system parts support can result in lower inventories.

B. RECOMMENDATIONS

1. Full Speed Ahead with JTAV

JTAV is critical to the success of military inventory management. It is impossible to effectively manage inventory without knowing exactly what items are stored and where they are stored. JTAV is the enabler to improving customer confidence in the supply system's ability to support deployed forces.

2. Continue the Standardization of Accounting Systems

JTAV's effectiveness will be diminished if cross-service purchases of items are not possible because of differing accounting systems. DFAS has made good headway in reducing duplication of the services' accounting systems. DFAS should press on with these efforts, so that JTAV can be truly effective.

3. Secretary of Defense Should Standardize the Definition of Excess Inventory

All four armed services and DLA use a different definition of excess inventory. The Navy definition is a protection level plus eight years consumption at current rates. The Army uses a protection level plus one EOQ. DLA uses six years consumption at current rates with no protection levels. The Air Force and Marine Corps definitions are different from all of the above.

In addition to differing on the number of items considered excess, the services also differ on the valuation of these items. Sometimes a service uses the current purchase

price, sometimes the original purchase price, and at other times the salvage value. Standardizing the definition of excess and its method of valuation would enable consistent measurement of total DoD excess inventory, and provide a benchmark for future improvements.

4. NAVICP Should Standardize Training for Navy Item Managers

Currently, there are no training requirements necessary to become an item manager. NAVICP Academy is voluntary. As a result, there is wide variation in the knowledge base, skill levels, and priorities of Navy item managers. The author recommends a mandatory extended ICP Academy for all item managers prior to assuming their position, followed by PQS and a formal mentoring program. This initiative would help standardize skills, policies, and procedures throughout NAVICP. Both the Army and DLA have such a program in place, and they have found it beneficial. The extended ICP Academy would cover all basic skills needed to become an item manager, and would include the computer skills necessary to execute these tasks.

5. DLA Should Teach a Comprehensive Computer Skills Course for the Supply Asset Material Management System (SAMMS)

Currently, the DLA courses for SAMMS are fragmented and have little connection to each other. Each covers only a specific skill. A comprehensive computer course would enable DLA item managers to effectively utilize the entire SAMMS system, directly improving their efficiency.

6. NAVAIR, NAVSEA, and NAVICP Should Teach the Program Offices and IWSST about Each Other's Operations and Priorities

Training the NAVICP IWSST and the weapons system Program Offices to understand each other's priorities and anticipate each other's operations, coupled with improved communication between the two offices, might reduce generation of excess. For instance, if a Program Office knows the schedule at which a weapons systems will be phased out, they could communicate this to the NAVICP IWSST, possibly reducing or averting a procurement action. If the fleet changes the operational use of an item, thus reducing its demand, the same scenario applies. If IWSST equipment specialists know of

reliability improvements that should reduce demand, NAVICP could reduce initial procurements and communicate this to the Program Office. By working together, these two groups could eliminate the deleterious impact of their actions upon each other.

7. CNO Should Institute Supply Principles Indoctrination as Part of Unit Commander Training, and Reinforce the Importance of Logistics in Battle Planning

Logistics support and its proper application are critical to battlefield success. Unit commanders are experts in strategy and tactics, but often lack sufficient knowledge of logistics and supply principles. The emphasis on logistics in unit commander training should be increased. However, as this thesis has shown, training alone is not the answer. It needs to be coupled with changes in other organizational design factors such as reward systems and management /control systems to be effective. This combination should alleviate some of the excess inventory caused by hoarding or multiple ordering.

8. Congress Should Conduct a Review of the National Stockpile

The National Stockpile was created years ago to ensure the self-sufficiency of the United States in wartime. Since that time, warfare has radically changed and the United States is now dependent on truly global trade to support its interests. Meanwhile, the National Stockpile has remained largely unchanged. It often holds items that are appropriate to the warfare of generations ago. A comprehensive review by Congress is in order. Many of these items are no longer critical to national security, while there may be other items not currently held that should be.

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